REVIEW OF FISH AND WILDLIFE SERVICE

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MAIN
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HEARINGS

BEFORE THE

COMMITTEE ON MERCHANT MARINE AND FISHERIES HOUSE OF REPRESENTATIVES

EIGHTY-FIFTH CONGRESS

SECOND SESSION

JANUARY 10, 13, 14, AND 15, 1958

Printed for the use of the Committee on Merchant Marine and Fisheries

UNITED STATES
GOVERNMENT PRINTING OFFICE
21168 WASHINGTON : 1958

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REVIEW OF FISH AND WILDLIFE SERVICE

FRIDAY, JANUARY 10, 1958

HOUSE OF REPRESENTATIVES,
COMMITTEE ON MERCHANT MARINE AND FISHERIES,
Washington, D. C.

The committee met at 10 a. m., Hon. Herbert C. Bonner (chairman) presiding.

The CHAIRMAN. The committee will come to order.

I first want to express my appreciation to the committee for the cooperation given in the last session of the Congress. I wish you all a delightful and happy New Year with the assurance that the cooperation of the Chair will continue with you. I anticipate and expect the cooperation of the membership of the committee, though probably during the year we might have some differences.

I want to congratulate on behalf of the committee our distinguished friend, the Honorable John Allen, on the delightful excursion that he made in 1957, and I want to congratulate him on his marriage. I want also to congratulate another member of the committee, Mr. Sheehan, on the addition to his family.

Each year it is the duty of the chairman of the committee to appoint a Board of Visitors to the Coast Guard Academy and the Merchant Marine Academy. These are splendid institutions that come under the jurisdiction of this committee. Much to my regret we did not send a Board of Visitors last year. I appointed a Board of Visitors but on account of complications we did not have representation. So I wish the membership of the committee would think it over. I wish that the minority members who are interested in being on one of these boards would report to Mr. Tollefson and the majority members who are interested and who would like to be a member of the board would mention it to me so we can appoint a Board of Visitors that will function.

The members will recall the Fisheries Reorganization Act passed at the close of the 84th Congress.

During the many hearings and conferences out of which the legislation emerged, I and other members were under the impression that there would be only 15 or 20 additional employees. But, at a hearing held before this committee early last year, officials of Fish and Wildlife Service stated that some 200 additional employees would be required. Thereafter I, and other members of the committee, communicated with Mr. Leffler to express our view that the proposed number was excessive. A number of conferences were held with Mr. Leffler and largely, through his efforts, the number was cut down to 31.

In view of the interest of the committee, I thought it desirable to have Mr. Leffler appear and explain just where the increase occurs and to answer questions concerning any phase of the new organization.

In addition, over the years, this committee has reported legislation authorizing studies of particular fish species, and annual appropriations were made to support the studies. The Saltonstall-Kennedy Act has made annual appropriations unnecessary, and I believe that the time has come for the Fish and Wildlife Service to render an account of its activities in these various fields and to report on the results obtained.

The committee will hear Mr. Leffler on the progress of the reorganization and on Monday and Tuesday of next week, will hear the directors of the Bureau of Commercial Fisheries and Sport Fisheries and Wildlife on the progress of the individual studies.

STATEMENT OF ROSS L. LEFFLER, ASSISTANT SECRETARY FOR FISH AND WILDLIFE, DEPARTMENT OF THE INTERIOR

Mr. LEFFLER. Mr. Chairman and gentlemen of the committee, I have a short prepared statement which I would like to have your permission to read and then I will try to answer any questions.

My name is Ross L. Leffler, Assistant Secretary for Fish and Wildlife, a position that was established by the Fish and Wildlife Act of 1956. This was a major piece of legislation sponsored by this committee.

I am happy to be here this morning and to place before you a record of the United States Fish and Wildlife Service and its two constituent bureaus, the Bureau of Commercial Fisheries and the Bureau of Sport Fisheries and Wildlife. It is particularly appropriate that this hearing be held because of the major reorganization that was contemplated in the act and because the activities of the Service are being reevaluated with the view of reemphasizing those areas of investigation and operations that need special attention, and with the view of revising programs to carry out the declaration of policy as stated in the act.

The testimony will attempt to accomplish a number of things: to acquaint this committee as intimately as possible with the organization and its functions, the accomplishments since the last hearings in 1955, some of the problem areas that you may be expected to hear about from time to time, as well as the needs that have developed as a result of reviewing our activities and realining our activities to be of better service to the public.

REORGANIZATION

The Fish and Wildlife Act of 1956 directed the establishment of a United States Fish and Wildlife Service. It established the position which I now am honored to occupy, that of Assistant Secretary for Fish and Wildlife, and a commissioner who administers, under his supervision, the functions of the United States Fish and Wildlife Service.

The act also created two separate Bureaus having the status of other Federal bureaus: the Bureau of Commercial Fisheries and the Bureau

of Sport Fisheries and Wildlife, each of which has a Director. The responsibilities of each Bureau were specifically listed in the act.

The usual reorganization process consolidates organizations or programs with the object of obtaining savings in personnel and money; or it may be designed to bring about increased efficiency. The objective of this reorganization was increased efficiency but more specifically to obtain emphasis on certain problem areas by dividing the operations into two fields of activity—the sports area and commercial fisheries.

Separation of activities into two major units must necessarily result in a larger number of supervisory personnel and people to carry on housekeeping for the separate agencies. Considerable thought and planning was given this problem in order to carry out the intentions of the act as economically as possible. The Senate Committee on Appropriations in Conference Report No. 653 placed limitations upon funds to be used for various segments of the organization and expressed the policy to have separate administrative services for the Bureaus without increasing the amount of funds available for this purpose.

By working closely with your committee, we have arrived at an operating organization that is economical and will serve our needs at this time. A plan has been developed for separate administrative service for the Bureaus. This plan has been approved by the Bureau of the Budget in accordance with congressional requirement.

At this point, I would like to call your attention to the chart showing the present organization of the Service. This reorganization of functions was accomplished by abolition of some positions, redefining others, and some transfers. The net result is the establishment of 31 new positions under the Reorganization Act. An additional 15 positions result from the directions of the conference committee in Report No. 653 to separate administrative services. I would like to introduce into the record my letter to you dated October 31, 1957, explaining the adjustments that have been made, and charts showing the staffing patterns for each Bureau. These show that the next change in personnel resulting from reorganization.

In the Bureau of Sport Fisheries and Wildlife all actions that need to be taken at this time have been completed.

The Bureau of Commercial Fisheries must of necessity act more slowly. The major Washington structure has been completed. Regional offices have been located and regional directors selected. The implementation of programs through these offices was discussed this week with the regional directors in conference in Washington. The plans developed here will be carried out as soon as possible. I am proud to say that all of this has been accomplished almost entirely with personnal from within the Service.

OTHER PROBLEMS

A number of other problems affecting the welfare of wildlife and fisheries have come to the fore. All of these will be discussed in detail by the Bureau Directors.

The CHAIRMAN. The letter and data that you referred to in your statement will be inserted in the record at this point.

(The letter and data referred to are as follows:)

WASHINGTON, N. C., *November 4, 1957.*

ROSS LEFFLER,
Assistant Secretary, Department of the Interior,
Washington, D. C.

DEAR MR. LEFFLER: I thank you for your two letters of October 30 and 31. I am satisfied and pleased with the agreements we reached, and I am writing Mr. Gross sending him a copy of your letter explaining just how we worked this out.

It was a pleasure having you and Mr. Suomela here in my home town and I look forward to a very pleasant association throughout the coming year.

With assurance of my high esteem, I am

Sincerely,

HERBERT C. BONNER.

DEPARTMENT OF THE INTERIOR,
OFFICE OF THE SECRETARY,
Washington, D. C., October 31, 1957.

Hon. HERBERT C. BONNER,
Member of Congress, Washington, D. C.

DEAR MR. BONNER: At our conference in your office on Tuesday, October 29, relative to the reorganization of the Fish and Wildlife Service, Commissioner Suomela and I submitted for your consideration data showing a total of 51 new positions necessary to bring about an efficient and economical reorganization of the Service as directed by the act of 1956. These positions are divided as follows:

Five of the positions are in my immediate office and include a special assistant, an administrative assistant, two stenographers, and myself. You understand, of course, that these are not Fish and Wildlife Service personnel but are charged to the Office of the Secretary. However, I am including them for purposes of record.

There are an additional 15 positions in the above 51 total which would result from a mandate of the Congress in the 1957 Conference Report No. 53 of the Appropriations Committee, which directs us to submit to the Bureau of the Budget an organization plan for separating the administrative functions of the Service and placing them in the two Bureaus. Such a plan has been submitted to the Bureau of the Budget, but at this time we cannot be sure that it will receive Budget's approval.

This then leaves a total of 31 positions which are the result of the improved and additional services we are developing to carry out the Reorganization Act. The breakdown of these 31 positions is as follows:

Of that total, the largest item involves the 16 positions created by the proposed establishment of regional offices for the Bureau of Commercial Fisheries to make possible the better coordination of field activities in that important resource management area and to bring closer to the industry the administration of these local services. These 16 positions will be offset in part by a reduction of 4 positions in the existing regional offices of the Service which now become the regional headquarters of the Bureau of Sport Fisheries and Wildlife, making a net increase from this new regionalization of 12 positions. In addition, the Bureau of Commercial Fisheries will need three other new personnel.

Involved in the establishment of the Commissioner's Office are 9 new positions, and the Bureau of Sport Fisheries and Wildlife will require 7 new positions to carry out its reorganization. Money for all the positions involved, as you know, is provided in the appropriations made by the Congress during its last session. Additional information in detail about these 31 new positions is as follows:

OFFICE OF THE COMMISSIONER

The Office of the Commissioner is composed of the Commissioner's Office, the Office of Program Review, the Office of Information, and the Office of International Relations.

Three new positions are in the Commissioner's Office—the Commissioner of Fish and Wildlife, established by law to supervise the functions of the United States Fish and Wildlife Service; his secretary, and a special assistant.

The Office of Program Review is responsible for the development of recommendations for the coordination by the Commissioner of fish and wildlife programs and policies established by the Department; reviews programs of the Bureaus to prevent overlapping, insure coordination, and suggest ways of improvement; coordinates legislative programs of the Service; examines regulations and other material for the Federal Register, and is responsible for safety programs of the Service. The 4 new positions in the Office of Program Review are: Director, legislative and regulations coordinator, and 2 secretaries.

The Office of Information acts in a staff advisory capacity in the development of information-education-extension programs for fish and wildlife for the Service and its two Bureaus and in the coordination of such programs with similar ones of other Government and private agencies concerned with resource management; prepares and reviews speeches, statements, and reports; supplies current information, visual aid, and editorial services, and supervision of in-service training in the information-education field. The two new positions are the Director and his secretary.

The Office of International Relations advises and assists the Commissioner on foreign policy as it affects fish and wildlife interests. No change is being made in its functions except to plan greater emphasis on the work of the international commissions. There are no new positions included for this office.

BUREAU OF COMMERCIAL FISHERIES

The Bureau of Commercial Fisheries, comprising a Director's Office and three Divisions of Biological Research, Industrial Research and Services, and Resource Management, conducts research on our commercial fisheries resources, manages the fisheries in Alaska, and provides marketing and statistical services. The Division of Biological Research conducts the fisheries research and recommends measures for managing commercial fisheries resources. The Division of Industrial Research and Services conducts technological and economic research and marketing studies, and disseminates statistical information. The Division of Resource Management manages the Alaska fisheries and the fur seal resource and is concerned with the development of the Columbia River fisheries.

A net increase of three positions is required in the executive direction of the Bureau in the central office to permit appropriate supervision of the Bureau's expanded activities under the Fish and Wildlife Act of 1956. The new positions are required because of the establishment of a Branch of Shell Fisheries in the Division of Biological Research, and a Branch of Marine Mammals and a Branch of Columbia River Fisheries in the Division of Resource Management. The addition of 2 new branch chiefs, 1 new assistant branch chief, and 4 new secretaries, a total of 7, is partially offset by the abolishment of 2 assistant branch chiefs and 2 secretary positions, making the net increase of 3. There are no increases in the Division of Industrial Research and Services or in the Office of Loans and Grants.

The Bureau's field activities which are being regionalized formerly were supervised directly from Washington. However, the increased scope of the Bureau's activities now requires the local contact, close coordination, and immediate decisions at the field level which only regionalization can provide. Staffing the regions involves 16 new positions, as follows: A regional director, an assistant regional director, and their 2 secretaries in 3 new regions, the Pacific, the Gulf and South Atlantic, and the North Atlantic; a regional director and secretary in 1 new region, the Great Lakes and Central; a program officer and secretary in southern California to supervise activities concerned with some of the Nation's largest fisheries in that area. There is no change in the existing Alaska region.

BUREAU OF SPORT FISHERIES AND WILDLIFE

The Bureau of Sport Fisheries and Wildlife, comprising a Director's Office and 3 Divisions of Sport Fisheries, Technical Service, Wildlife, operates 500 refuges, management areas, fish hatcheries and experiment stations; is responsible for conservation and management of migratory birds; carries on specific fish and wildlife management on Federal lands and to supplement work of the States, and administers Federal assistance and coordination programs for fish and wildlife.

An increase of two positions in the Director's Office is provided to expedite the handling of the planning and executive direction supervision of the additional services for recreational fisheries and wildlife which are being established under

the new program launched by the 1956 act. The new Federal activities are designed specifically to supplement the fish and wildlife work of the various States The two positions are an assistant director and a secretary. Special conservation education work of the Bureau, one of the functions of the Director's Office, is being handled by the transfer of an existing position.

The new Division of Sport Fisheries is created to supervise the expanded programs for fundamental research and management for sport fisheries resources with special attention to technical assistance to the States and other agencies concerned with such problems. The establishment of the new research and management activities for sport fisheries in the Division involves a net increase of 5 positions; these include a new Chief of the Division and his secretary (2 positions). Four new positions also are established in the new Fishery Research Branch. These are a branch chief, an assistant branch chief, a secretary and an administrative assistant. However, 1 of these 4 positions is offset by the transfer of an existing position from the former Branch of Fishery Biology, now the Division of Biological Research in the Bureau of Commercial Fisheries, making a net increase of only 3 positions for Fishery Research. No new positions are involved in the establishment of the Fishery Management Services Branch or in the continuing fish hatchery program.

The Division of Technical Services supervises engineering, Federal aid, statistics, river basins and realty programs of the Bureau. No new positions are involved.

The Division of Wildlife supervises the wildlife management and research activities of the Bureau, including enforcement of Federal regulations for the conservation of migratory birds, control of depredations by migratory birds and other nuisance wildlife, the operations of refuges for migratory waterfowl and certain big game, including vanishing species; the conduct of a broad-scale research program for resources which are the responsibility of the Federal Government, and the provision of technical assistance to other agencies. No new positions are involved.

These are all the facts with respect to our implementation of the United States Fish and Wildlife Service as directed by the Congress. We do want to express to you our appreciation for your helpfulness, and the splendid cooperation shown by your staff, in working out this very difficult problem. I believe the conclusion we now have reached will bring about the most efficient and economical handling of the reorganization and will accomplish the purposes for which the Fish and Wildlife Act was passed.

Sincerely yours,

ROSS LEFFLER,
Assistant Secretary.

TOPICS TO BE DISCUSSED

Bureau of Commercial Fisheries:
- Tuna program
- Pacific salmon investigations
- Columbia River fish protection research
- Pacific sardine studies
- Striped bass
- Sea lamprey
- Commercial shellfish
- Shrimp
- Red tide
- Estuarine
- Sea nettles
- Fisheries loan fund
- Seals
- Saltonstall-Kennedy

Sport fisheries and wildlife:
- Economic Survey Report
- Wetlands
- Enforcement
- Bird depredations
- Insecticides and pesticides
- Sport fisheries

DEPARTMENT OF THE INTERIOR,
OFFICE OF THE SECRETARY,
Washington, D. C., October 30, 1957.

Hon. HERBERT C. BONNER,
Member of Congress, Washington, N. C.

DEAR MR. BONNER: On behalf of Mr. Suomela and myself I want to express our appreciation for your giving us the time Tuesday to discuss the problems of the Fish and Wildlife Service.

Your sympathetic understanding is most helpful. The reorganization has been somewhat difficult, but I feel that we now have a program which will be efficient as well as economical. It was a real pleasure to visit with you in your home, and will you please convey to Mrs. Bonner our thanks for her gracious hospitality.

I am enclosing the organization chart that you marked in your office and the letter which we discussed will come forward in a day or so.

Sincerely,

ROSS LEFFLER,
Assistant Secretary.

Explanation of additional positions required for reorganization

Grade and title	Incumbent	Status of action	Increase	Decrease
Commissioner, GS-18	Arnie J. Suomela	Completed	1	
Special assistant to Commissioner, GS-15	Robert H. Johnson	do	1	
Personal assistant, GS-9	Johanna H. Corsack	do	1	
Office of Program Review:				
Director, GS-16	O. Lloyd Meehean	Pending	1	
Legislative and regulations coordinator, GS-14	Alva F. Rollins	Completed	1	
Safety officer, GS-14	John N. Ball	Existing		
Secretary to Director, GS-7	Doris R. Wilkerson	Pending	1	
Secretary to legislative coordinator, GS-6	Vacant	Vacant	1	
Secretary to safety engineer, GS-6	George Coffee	Existing		
Office of Information: [1]				
Director, GS-15	Robert A. Wells	Pending	1	
Secretary to director, GS-6	Pauline M. Kephart	do	1	
Office of International Relations:				
Fish and Wildlife Administrator, GS-14	Stillman Wright	Existing position		
Foreign Affairs specialist, GS-13	William M. Terry	do		
Administrative assistant, GS-9	Bess Hughes	do		
Secretary, GS-5	Annis L. Kentgens	do		
Secretary, GS-5	Alexandria S. Zamanakos.	do		
Total			9	0

[1] 22 other positions already existing.

Bureau of Commercial Fisheries staffing pattern

DIRECTOR'S OFFICE

Grade and title	Incumbent	Action	Increase	Decrease
GS-17, Director (BCF)	D. L. McKernan	Appointed	1	
GS-9, secretary	Bertha Fuss	do	1	
GS-15, Assistant Director (BCF)	A. W. Anderson	do	1	
GS-7, secretary	Mildred Flavin	do	1	
GS-16, Associate Director (FWS)	A. J. Suomela	Abolished		1
GS-15, assistant to the Director (FWS)	Robert Wells	do		1
GS-7, secretary (FWS)	Johanna Corsack	do		1
Total			4	3
Net increase			1	

***Bureau of Commercial Fisheries staffing pattern*—Continued**

DIVISION OF BIOLOGICAL RESEARCH

Grade and title	Incumbent	Action	Increase	Decrease
GS–15, Division Chief	A. L. Tester	Appointed	1	
GS–14, Branch Chief	L. A. Walford	To be abolished		1
GS–13, Chief, Section of Inland Fisheries.	W. F. Carbine	do		1
GS–13, Chief, Section of Anadromous and Shellfisheries.	R. P. Silliman	do		1
GS–14, Chief, Branch of Anadromous Fisheries.	do	To be established	1	
GS–14, Chief, Branch of Shellfisheries		do	1	
GS–13, Chief, Section of Marine Fisheries.	H. H. Eckles	To be abolished		1
GS–14, Chief, Branch of Marine and Inland Fisheries.	do	To be established	1	
GS–11, Assistant Chief, Section of Marine Fisheries.	H. L. Moore	To be abolished		1
GS–13, Assistant Chief, Branch of Marine and Inaland Fisheries.	do	To be established	1	
GS–13, Assistant Chief, Branch of Anadromous Fisheries.		do	1	
GS–9, administrative assistant	C. W. Criscione	No change		
GS–7, administrative assistant (correspondence).	L. T. Dees	do		
GS–7, publications editor		Selection pending		
GS–7, secretary to Division Chief		do	1	
GS–5, secretary to Branch Chief	B. B. Griffith	To be abolished		1
GS–6, secretary to Chief, Branch of Anadromous Fisheries.	M. S. Fukuyama	No change		
GS–6, secretary to Chief, Branch of Shellfisheries.		Selection pending	1	
GS–6, secretary to Chief, Branch of Marine and Inland Fisheries.		do	1	
Total			9	6
Net increase			3	

DIVISION OF INDUSTRIAL RESEARCH AND SERVICES[1]

GS–15, Division Chief	H. E. Crowther	Appointment pending.	1	
GS–14, Branch Chief	A. W. Anderson	Abolished		1
GS–6, secretary to Division Chief	J. Montgomery	Appointment pending.	1	
GS–6, secretary to Branch Chief	M. Flavin	Abolished		1
GS–4, clerk, Office of Division Chief	R. Huard	Appointment pending.	1	
GS–4, clerk, Office of Branch Chief	do	To be abolished		1
GS–13, 1st Assistant Branch Chief	R. T. Whiteleather	do		1
GS–13, 2d Assistant Branch Chief	Vacancy	do		1
GS–5, secretary to 1st Assistant Branch Chief.	J. Montgomery	do		1
GS–5, secretary to 2d Assistant Branch Chief.	Vacancy	do		1
GS–13, S–K coordinator	H. E. Crowther	Selection of replacement pending.		
GS–5, secretary to S–K coordinator	D. Walther	No change		
GS–9, administrative assistant	V. Whorley	do		
GS–5, clerk	M. Simms	do		
GS–4, clerk (administrative)	B. Thompson	do		
Total			3	7
Net decrease				4

[1] There will be no increase or decrease in personnel at organizational levels below the Division Chief's office.

Bureau of Commercial Fisheries staffing pattern—Continued

DIVISION OF RESOURCE MANAGEMENT

Grade and title	Incumbent	Action	Increase	Decrease
GS-15, Division Chief	R. C. Baker	Appointment pending.	1	
GS-7, administrative assistant	C. Williams	No change		
GS-6, secretary	S. Wheeler	do		
Branch of Alaska Fisheries:				
GS-14, Chief	Vacant	Appointment pending.		
GS-13, Assistant Chief	R. C. Baker	Abolished		1
GS-12, fishery management biologist.	D. W. Erickson	No change		
GS-5 secretary	B. Hurley	do		
Branch of Columbia River Fisheries:				
GS-14, Chief	Vacant	Appointment pending.	1	
GS-4, secretary	do	do	1	
Branch of Marine Mammals:				
GS-14, Chief	do	do	1	
GS-12, administrative officer	C. R. Lucas	No change		
Total			4	1
Net increase			3	

FIELD POSITIONS

GS-15, Regional directors:				
Alaska [1]	John Gharrett	Acting pending appointment.		
Pacific	Samuel Hutchinson	Appointment pending.	1	
Gulf and South Atlantic	Seton Thompson	Acting pending appointment.	1	
North Atlantic	Joseph Puncochar	do	1	
Great Lakes and Central	W. F. Carbine	Appointment pending.	1	
GS-14, Assisstant regional directors:				
Alaska (3) [1]	Howard Baltzo	do		
	William Royce	do		
	Vacancy	Selection pending.		
Pacific		do	1	
Gulf and South Atlantic	Richard Whiteleather	Appointment pending.	1	
North Atlantic		Selection pending.	1	
GS-14, Program officer		do	1	
GS-6, Secretaries for regional directors:				
Alaska [1]		do		
Pacific		do	1	
Gulf and South Atlantic		do	1	
North Atlantic		do	1	
Great Lakes and Central		do	1	
GS-5, Secretaries for assistant regional directors:				
Alaska (3) [1]		do		
Pacific		do	1	
Gulf and South Atlantic		do	1	
North Atlantic		do	1	
GS-5, Secretary for program officer, southern California		do	1	
Total			16	
Net increase			16	
Grand total net increase			19	

[1] No increase or decrease in number of personnel in Alaska. Title changes only from Administrator and Assistant Administrators of Alaska Commercial Fisheries and secretaries to regional director and assistant regional directors and secretaries.

Bureau of Sport Fisheries and Wildlife staffing pattern

DIRECTOR'S OFFICE

Grade and title	Incumbent	Action	Increase	Decrease
GS–17, Director	Daniel H. Janzen	Appointed	1	
GS–9, secretary to Director	Edith M. Knight	do	1	
GS–15, Assistant Director	Abram V. Tunison	do	1	
GS–7, secretary to Assistant Director	Evelyn Ruth Sager	do	1	
GS–15, Assistant Director	Lansing A. Parker	do	1	
GS–7, secretary to Assistant Director	Helen Mackall	do	1	
GS–17, Director, Fish and Wildlife Service.	John L. Farley	Position abolished		1
GS–9, secretary to Director Farley	Edith M. Knight	do		1
GS–15, Assistant Director, Fish and Wildlife Service.	Robert H. Johnson	do		1
GS–6, secretary to Assistant Director, Fish and Wildlife Service.	Winifred W. Deering	do		1
Total			6	4
Net increase			2	

DIVISION OF WILDLIFE

GS–15, Division Chief	Vacant	Negotiation letter approved, candidate contacted.	1	
GS–6, Secretary to Division Chief	do	Action held pending appointment of Division Chief.	1	
Branch of Wildlife Refuges		No change		
Branch of Wildlife Research		do		
Branch of Management and Enforcement.		do		
Branch of Predator and Rodent Control.		do		
GS–15, Assistant Director, Fish and Wildlife Service.	Lester Bagley	Position abolished.		1
GS–6, secretary	Pauline Kephart	do		1
Total			2	
Net increase			0	

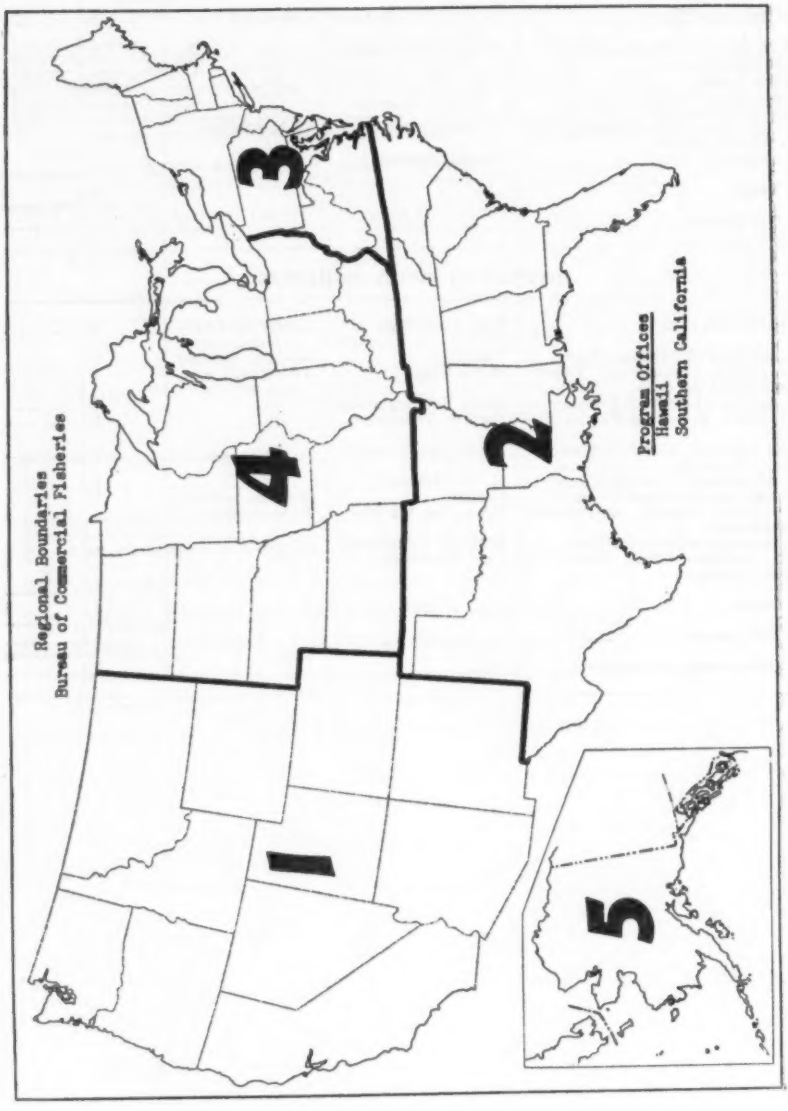
Bureau of Sport Fisheries and Wildlife staffing pattern—Continued

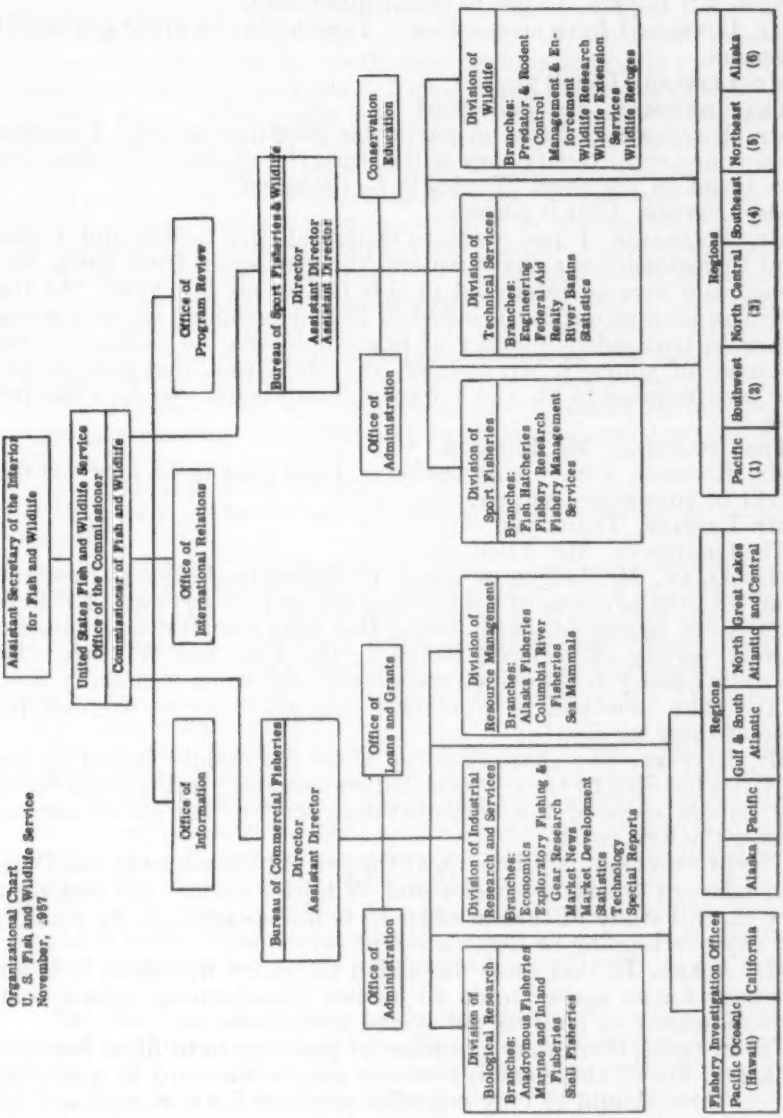
DIVISION OF TECHNICAL SERVICES

Grade and title	Incumbent	Action	Increase	Decrease
GS-15, Division Chief	Robert M. Rutherford.	Appointed	1	
GS-6, secretary to Division Chief	Winifred W. Deering	do	1	
Branch of Engineering		No change		
Branch of Lands		do		
Branch of River Basins		do		
Branch of Federal Aid		do		
GS-15, assistant to the Director, Fish and Wildlife Service.	O. Lloyd Meehean	To be abolished		1
GS-6, secretary	Doris Wilkerson	do		1
Total			2	2
Net increase			0	

DIVISION OF SPORT FISHERIES

GS-15, Division Chief	John Gottschalk	Acting pending appointment.	1	
GS-6, secretary to Division Chief	Vacant	Selection pending	1	
GS-14, Chief, Branch of Fishery Management Services.	Willis King	Acting pending appointment.	1	
GS-6, secretary to Branch Chief	Betty R. Vaughndorf	do	1	
GS-14, Chief, Branch of Fishery Research.	Paul E. Thompson	do	1	
GS-13, Assistant Chief, Branch of Fishery Research.	Bruno von Limbach	do	1	
GS-7, administrative assistant	H. M. Mugmon	do	1	
GS-6, secretary to Branch Chief	Vacant	Selection pending	1	
GS-12, Chief, Section of Fisheries Management.	Bruno von Limbach	To be abolished		1
GS-5, secretary to Section Chief	Betty R. Vaughndorf	do		1
GS-13, Assistant Chief, Branch of Fishery Biology.	Paul Thompson	do		1
Total			8	3
Net increase			5	
Grand total, net increase			7	


Regional Boundaries
Bureau of Commercial Fisheries
Program Offices
Hawaii
Southern California
1
2
3
4
5


Organizational Chart
U. S. Fish and Wildlife Service
November, 1957
Assistant Secretary of the Interior for Fish and Wildlife
United States Fish and Wildlife Service
Office of the Commissioner
Commissioner of Fish and Wildlife
Office of Information
Office of International Relations
Office of Program Review
Bureau of Commercial Fisheries
Director
Assistant Director
Bureau of Sport Fisheries & Wildlife
Director
Assistant Director
Assistant Director
Office of Administration
Office of Loans and Grants
Office of Administration
Conservation Education
Division of Biological Research
Branches:
Anadromous Fisheries
Marine and Inland Fisheries
Shell Fisheries
Division of Industrial Research and Services
Branches:
Economics
Exploratory Fishing & Gear Research
Market News
Market Development
Statistics
Technology
Special Reports
Division of Resource Management
Branches:
Alaska Fisheries
Columbia River Fisheries
Sea Mammals
Division of Sport Fisheries
Branches:
Fish Hatcheries
Fishery Research
Fishery Management Services
Division of Technical Services
Branches:
Engineering
Federal Aid
Realty
River Basins
Statistics
Division of Wildlife
Branches:
Predator & Rodent Control
Management & Enforcement
Wildlife Research
Wildlife Extension Services
Wildlife Refuges
Fishery Investigation Offices
Pacific Oceanic (Hawaii)
California
Regions
Alaska
Pacific
Gulf & South Atlantic
North Atlantic
Great Lakes and Central
Regions
Pacific (1)
Southwest (2)
North Central (3)
Southeast (4)
Northeast (5)
Alaska (6)

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The CHAIRMAN. Does that conclude your general statement?

Mr. LEFFLER. That is correct.

The CHAIRMAN. I might point out that the letter referred to has been duplicated and each member has a copy of it in front of him.

Now, Mr. Boykin, do you have any questions?

Mr. BOYKIN. I have no questions. I think that he made a splendid statement.

Mr. LEFFLER. Thank you, sir.

The CHAIRMAN. Mr. Tollefson?

Mr. TOLLEFSON. I have no particular questions as yet. I assume when your people testify they will discuss the various items that you have listed on the sheet "Topics to be discussed."

Mr. LEFFLER. That is correct.

Mr. TOLLEFSON. I just want to commend Mr. Leffler, and I also want to commend our chairman and the gentleman from Iowa, Mr. Gross, who were so interested in this matter all last year. As the chairman pointed out at the outset, it looked as though we were going to have a tremendous number of new employees, but because of the insistence of yourself, Mr. Bonner, and Mr. Gross, that number has now been reduced to 31, and I want to compliment you on a fine job done.

The CHAIRMAN. Mr. Robeson.

Mr. ROBESON. I have no questions. I am glad to be here for the benefit of your statement, sir.

Mr. LEFFLER. Thank you, sir.

The CHAIRMAN. Mr. Allen.

Mr. ALLEN. Mr. Leffler, on a visit to the regional office at Portland I ran into the problem of contracting for certain services. I believe there is one agency in that building that runs the IBM machines for a great variety of services, including the Fish and Wildlife. Do the charts that you show indicate whether the work is actually done by the office involved, or whether it has authority to contract for some of those services?

Mr. LEFFLER. The chart does not show the details, including the activities handled by the consolidated services office in Portland which will handle some of the administrative services for all of our offices on the west coast.

The procurement is, I believe, at the present time done in the Portland office of Sports Fisheries and Wildlife, but we are making a very careful study of that in order to reduce as much as we possibly can any overlapping or duplication of personnel.

Mr. ALLEN. In that same discussion the point was made it is not necessary for an agency to do all its own housekeeping to have complete autonomy in both its policy and administration.

For instance, there were a number of positions to be filled from the rank and file of the classified service and it was said in many instances there should be only one office required for that rank and file type of employment still preserving the ability to control policy in the manner in which it was administered in the person repsonsible for it.

I am just curious to know whether we, in our framing of the law that was passed, so provided that we could get the independent bureaus we want and did not sacrifice some of the ability of the Government to consolidate these routine or housekeeping services.

Mr. LEFFLER. I think that I can answer your question in the affirmative. We are, in our reorganization plans, contemplating having much of the housekeeping done on the west coast through the consolidated departmental offices in Portland. I use the term "consolidated departmental offices" because sometimes people confuse that with our Fish and Wildlife office in Portland. We believe that will be successful. Whether that will be done in other parts of the United States or not, I do not know. I understand that is under study at the present time. That really does not come under my jurisdiction. I can say to you I do not believe a consolidation of the administrative functions in a neutral office such as the consolidated offices in Portland would in any way affect the autonomy of the other bureaus.

Mr. ALLEN. I also had an opportunity to visit the office in Hawaii. It seemed to me there we had almost a perfect example in practice of a regional office of the Bureau of Commercial Fisheries although it had none of the title. Is that approximately a correct statement?

Mr. LEFFLER. That is what we call a program office. They are out there on a research project largely financed from Saltonstall-Kennedy funds. That is not classified as a regional office, however.

Mr. ALLEN. To all intents and purposes it handles nothing but commercial fisheries. It handles all its own payrolls and a variety of other things?

Mr. LEFFLER. That is right.

Mr. ALLEN. There is enough flexibility to take care of both situations?

Mr. LEFFLER. That is correct. There is enough flexibility in the law, and I am quite certain we have the feeling if we have the situation whereby the proposed plans we have laid before the committee need revising, we will come to the committee and make our proposal for a change and give our reasons why it was not working. And I am quite certain that will be all we would require. The legislation does cover it adequately.

Mr. ALLEN. While I am talking about the office in Hawaii, the discussion there seemed to indicate the initial phases of the investigation had been pretty well covered during the last 8 or 10 years and now a new program for the next 10 years would have to be considered and set up. I just hazard a guess such a program over 10 years would cost in the neighborhood of $8 million or $10 million.

If that guess is anywhere near good, or even if it is not, would you think it well this committee should conduct another sort of supervisory investigation to indicate whether your future policies are in accord with ours?

Mr. LEFFLER. May I answer the question in this way: We are prepared on Monday to have the Bureau of Commercial Fisheries lay before this committee all of these particular problems, and I am hopeful you will get a satisfactory answer to your question when we delineate the progress of the programs we hope to have in the way of our commercial fisheries investigation.

The CHAIRMAN. In the act itself are you not given authority, when functions overlap, to delegate to either branch the authority to supervise and to make the operations successful?

Mr. LEFFLER. That is correct.

The CHAIRMAN. Does not that then take care of the situation expressed by Mr. Allen?

Mr. ALLEN. I was not too sure. We had quite a bit of discussion as to whether or not there should not be 2 separate personnel offices or whether there should not be 1 personnel office to make all appointments. It seems to me, as I talked to some of the people in the field, we had not distinguished between the high level policymaking people, or the high level administrative people, and the rank and file which come along with much less ability to direct policy. I did not know whether in providing complete separation we went too far and separated things that did not need to be separated.

The CHAIRMAN. During the discussion of the bill that was finally passed there was some anticipation of that, and that is what Mr. Leffler's position was created for.

Mr. LEFFLER. That is right.

The CHAIRMAN. To be more or less the umpire and to delegate authority to carry out functions so that there might not be any controversy in the separation.

Mr. LEFFLER. That is correct, sir.

The CHAIRMAN. I am greatly concerned that you will use your authority to do that, to hold down creation of new functions that are merely duplications.

Mr. LEFFLER. That is entirely correct.

The CHAIRMAN. That concerned me greatly in the creation of the new regional offices. From time to time during this reorganization there was a discussion of the vast number of office people and paperwork and a very, very thin distribution of personnel out in the field actually protecting wildlife. I have great concern about that phase of it. The field force has not increased at all, has it?

Mr. LEFFLER. No, sir, not as yet.

The CHAIRMAN. The migatory birds used to congregate in certain places and you could depend upon it, but they are all over creation now, and it is difficult for me to understand how the field force can protect them and carry out the directives of so many people in office—the regional office and the central office. The supervisory force is a great deal larger than the number of men seeing to it that the law is enforced and the birds are protected.

Do you contemplate any additional enforcement officers?

Mr. LEFFLER. I would like to answer that question in this way. I am not at all happy over our present enforcement setup, and we are making a very thorough study of that. It looks—and this is only tentative—as though in the enforcement end of it, or the field agent end of it in the continental United States, about a 20-percent increase would be necessary in order to cover the field a little more adequately.

Now, 20 percent seems like a large figure, but actually that means about 25 people. In Alaska where we need approximately a 50-percent increase in our enforcement group because of the responsibilities we have there we are very much shorter of men than we are in the continental part of the United States. That would mean about 12 people, so you see the total in manpower is not very great, although the percentages might look rather large.

We are making a very careful and thorough study of that and will have some recommendations. We do not want to come to you, sir, and say that we would like to have 20 percent increase in personnel and a 50 percent increase in personnel until we can lay it right across the

line and give you the facts and the places where they are needed and the reasons therefor.

The CHAIRMAN. When the new organization begins to function it may be possible you might discover you had more people in offices than you need and they could be reduced and applied to the field. Is such a thing as that possible?

Mr. LEFFLER. We are making a thorough study and are continuing our study of our organization structure.

The CHAIRMAN. And the existing field force could be consolidated to do new functions in the field; is that not true? For instance, you have the hunting field and the protecting season of migratory birds, and you have the protectors, and then you have another program after the hunting season closes. Could not that all be consolidated?

Mr. LEFFLER. In certain areas of the country there are some functions that should be—and I am going to use the word "consolidated"—under one man, which would give him, shall we say, a little greater stature than some of the other people.

The CHAIRMAN. Instead of having new people carry out depredation work, the protectors could carry that out as well as protecting because the hunting season would be over.

Mr. LEFFLER. That is entirely correct, sir. The game agents, as we call them, can and do carry on other functions, but we are thinking seriously of some additional functions for some of them—not all of them. It may not fit into the program. There are some places perhaps where we have excessive depredations which is not present in other parts of the country, but may require some functions in that particular area being loaded on the game agent, which might change the picture of his responsibilities. We have a few cases of that kind and Mr. Janzen and his staff are going over that very carefully right now.

The CHAIRMAN. Mr. Thompson.

Mr. THOMPSON. I was glad to hear your statement this morning. My district in Louisiana is interested in both Bureaus that you are creating.

Mr. LEFFLER. That is correct.

Mr. THOMPSON. There is a large accumulation of migratory birds there, as you know, and we are very much interested in the commercial fisheries.

Now, just for the record, do you have the same regional offices for both Bureaus, or do you have separate offices?

Mr. LEFFLER. The Sport Fisheries and Wildlife regional office in your area is located in Atlanta. The commercial fisheries for the gulf and South Atlantic area will be located in St. Petersburg, Fla., serving the gulf coast and Atlantic coast. We have a laboratory there, and in the interest of economy, perhaps my Scotch ancestry dictated we save as much rent as we possibly could.

Mr. THOMPSON. Is that the only laboratory you have in region No. 2?

Mr. LEFFLER. No, sir. We have a new laboratory at Pascagoula, which is about completed. We have had some difficulty in getting some of our equipment installed, but that laboratory has been functioning for some time. We have a new one there which will serve that area in particular. We have a ship, the *Oregon*, which has been doing

considerable deep sea work in locating new tuna grounds and other fishing grounds there.

Mr. THOMPSON. Do you think that the region office located in St. Petersburg on the extreme eastern part of the region would serve the commercial fishing area as well as if it were centrally located?

Mr. LEFFLER. The office is located reasonably centered to the area that it has to cover because it also has the South Atlantic area to take care of.

Mr. THOMPSON. I have no real feeling about where the office is located except I seem to remember some question as to whether the office should be located at St. Petersburg or farther westward where more people in the business would have access to the services of the office.

Mr. LEFFLER. We have representatives in New Orleans and in one of the Texas cities. I am sorry, but the name has slipped my mind at the moment. The area of the No. 2 region, the one that you are discussing, goes from Texas to North Carolina, so you see it is fairly large.

The CHAIRMAN. From the Virginia Capes around the gulf.

Mr. LEFFLER. Around the gulf; yes.

Mr. THOMPSON. The concentration of your real commercial fisheries, however, would be westward from your regional office, is that not so?

Mr. LEFFLER. We have the shrimp fishermen who come into that area and then we have the South Atlantic people along there, all the way down that coast, that we have to service out of that office. We are, of course, trying to keep the number of regional offices to the absolute minimum. We would like to try and see whether we can give the proper service. If not, we will take another look at it.

Mr. THOMPSON. If I can be of any assistance let me know. The people of my area were questioning this and I wanted some answer.

Mr. LEFFLER. There were two factors. The shrimp industry, after all, dollars-and-cents-wise, is the largest industry we have in the gulf, and also in the interest of economy, where we could get free quarters, that was another factor taken into consideration in putting our laboratory there.

Mr. THOMPSON. And later, of course, if you find a more central location to be advisable, you would have no compunction about changing?

Mr. LEFFLER. None whatever. After all, we are here to give service.

Mr. THOMPSON. Thank you, Mr. Leffler. That is all I have.

The CHAIRMAN. Mr. Van Pelt.

Mr. VAN PELT. I have no questions.

The CHAIRMAN. Mr. Gross.

Mr. GROSS. Mr. Leffler, how many new regional offices do we have for commercial fisheries?

Mr. LEFFLER. There is a commercial fisheries office in Seattle.

Mr. GROSS. I do not mean the individual offices. I want the total. How many regional offices do you have?

Mr. LEFFLER. For commercial fisheries, five.

Mr. GROSS. That is an increase of how many?

Mr. LEFFLER. Four.

Mr. GROSS. I believe you said that you are now proposing a net increase of 31 employees.

Mr. LEFFLER. 31 people.

Mr. GROSS. How many of those go into the new regional commercial fisheries offices?

Mr. LEFFLER. About 16.

Mr. GROSS. About half of them?

Mr. LEFFLER. Yes.

Mr. GROSS. That is a net increase of 31?

Mr. LEFFLER. That is correct, leaving out the administrative part. The administrative part will take 15.

Mr. GROSS. I am concerned, as is the chairman—and I told you so before—about the increase in the enforcement division of the Wildlife Service, particularly with respect to migratory waterfowl. You say this proposes no increase whatever in the staff of enforcement agencies?

Mr. LEFFLER. Not at this time. We are not getting any new men on that. We are filling the vacancies that occur, of course.

Mr. GROSS. How many game agents do you presently have?

Mr. LEFFLER. 128 in the continental United States.

Mr. GROSS. Do you think you may come up with a 20-percent increase in the enforcement branch?

Mr. LEFFLER. I think we need about a 20-percent increase in that number in order to do an adequate job, and we have to start to work toward getting that done. We do not expect to do it all at once, but at the present moment it looks very much as though we need a 20-percent increase in the continental United States, or approximately 25 people.

Mr. GROSS. Is it not true the pressure on migratory waterfowl is increasing every year?

Mr. LEFFLER. That is correct. Not only is the pressure increasing on the waterfowl but the area available to them is decreasing so the problem is growing every year.

Mr. GROSS. I wish you might have done something about that in this proposal you have here today. These 31 new positions are pending; is that correct?

Mr. LEFFLER. In the Bureau of Sports Fisheries it is completed. There were only seven involved in there. In the Commissioner's office there were nine positions involved, and in the Bureau of Commercial Fisheries we have the balance.

Mr. GROSS. How many would you say of the 31 are pending?

Mr. LEFFLER. All appointments have been made within the Service.

Mr. GROSS. Then you come here today with the increase completed; is that correct?

Mr. LEFFLER. Well, the administrative side has not been completed yet, but the program side, yes.

Mr. GROSS. How many are involved in the administrative side?

Mr. LEFFLER. Fifteen net.

Mr. GROSS. Is that a part of the 31?

Mr. LEFFLER. No, sir.

Mr. GROSS. They will be in addition to the 31?

Mr. LEFFLER. In addition to the 31. The 31 is the program increase. The 15 are the result of the conference report which requested

us to separate the functions of the administrative side so we feel that should be kept a separate item because it came after the reorganization act.

Mr. GROSS. That is all.

The CHAIRMAN. Mr. Baumhart.

Mr. BAUMHART. I have no questions.

The CHAIRMAN. Mr. Kluczynski.

Mr. KLUCZYNSKI. I have no questions.

The CHAIRMAN. Mr. Ray.

Mr. RAY. I have no questions.

The CHAIRMAN. Mr. Young.

Mr. YOUNG. I have no questions.

The CHAIRMAN. Mr. Pelly.

Mr. PELLY. I want to commend you for your wisdom in selecting Seattle as the location of the Commercial Regional Office.

I would like to inquire as to when would be the proper time to direct inquiry in this overall hearing as to the effect that Alaska statehood might have on your operations. Would that come at a later point in the hearings? I will ask you if you are ready to prepare for a change in the operation of the Department in the event legislation should pass in this Congress for statehood?

Mr. LEFFLER. We have been giving consideration to it, but it is my understanding that the transfer of the functions of the commercial fisheries, which is, of course, a very important segment of their activities, would take place over a 5-year period. There are certain other functions in Alaska that we undoubtedly would continue to administer. However, the function that we hold up there which is equivalent to a game commission in the States would be probably transferred from us to the State of Alaska when statehood takes place.

Mr. THOMPSON. May I object to that last question? He was asking a question on improbability.

Mr. PELLY. I have no wish in any way to inflict my views on statehood into this hearing. I am greatly concerned over the protection of our wildlife, and I am thinking in terms of our fur seal operation. Who is going to take care of that?

Mr. LEFFLER. We do.

Mr. PELLY. Who would get the profits from that operation? Are not the proponents of statehood planning on the State of Alaska getting the profits?

Mr. LEFFLER. In order to be sure that I am answering that question correctly, I will call on Mr. Corbin. Am I correct in answering that question this way—that disposition of the funds of the fur seal is subject to treaty?

Mr. CORBIN. The distribution of the seals, yes, but with regard to the proceeds, some of the bills that I have seen provided that the Territory gets 50 percent and the United States will retain the other 50 percent.

Mr. LEFFLER. I might answer your question this way: Naturally we have been giving thought to this. No firm plans have been materialized so far, and none will be until we know where we are going on this thing.

Mr. PELLY. Actually on the game-protection work you look to the State game protectors under a delegation of authority to do the field-work in large measure.

Mr. LEFFLER. The bulk of the enforcement work naturally, with the 128 people over the country we have, is done by the State game protectors with whom we work very closely.

Mr. PELLY. You have means to avoid duplication?

Mr. LEFFLER. Yes. We have a good relationship with the States.

The CHAIRMAN. Mr. Dingell.

Mr. DINGELL. Mr. Chairman, I am very hesitant about asking any more questions along the lines propounded by Mr. Pelly, but I think he has raised an important question for the committee to consider, and that is the impact of the game laws that may be included in this Alaskan statehood bill. I think perhaps that would be in the scope of this committee to look into. I would like to start out by commending you for a very fine presentation and commending you for the fine job you have done in this regard.

In regard to these positions, 16 positions go to the regional offices for the Bureau of Commercial Fisheries?

Mr. LEFFLER. That is correct.

Mr. DINGELL. Most of those positions you were actually compelled to create by the passage of the Reorganization Act itself?

Mr. LEFFLER. That was our intepretation. Also, it was the feeling if it was the feeling of the commercial fishermen who had a desire to have a closer liaison on the ground, we should establish an office where they could have access to it. We planned a director, an assistant director, and a couple of secretaries. It is really a contact man who has general overall supervision in the field to give better service to the commercial fishermen.

Mr. DINGELL. Are there other people in this reorganization plan that you have put before the committee today whom you are compelled to hire by changes in the Reorganization Act itself?

Mr. LEFFLER. The other area where the 15 people come in is the result of a conference report. The 31 positions are the ones we considered as directly related to the Reorganization Act.

Mr. DINGELL. And you are commanded to fill the positions by the Reorganization Act?

Mr. LEFFLER. That is correct.

Mr. DINGELL. A total of 31 then are imposed upon your Bureau by the law itself?

Mr. LEFFLER. That is correct.

Mr. DINGELL. Do you find as a result of this Reorganization Act there was a substantial increase in the number of your people who were devoting their time to commercial fishery problems, and then as a second part of that question, do you find that you have a substantial decrease, or I might say, a proportional decrease in emphasis, positions, and so forth, on the sports and conservation aspect?

Mr. LEFFLER. We had some problems in both areas. There were some needed changes in emphasis because when we transferred certain functions to the Bureau of Commercial Fisheries we had to reevaluate and reorganize on the other side of the fence, so it took seven positions to bring us up to where we needed to be to properly function in the sports fisheries and wildlife side.

Mr. DINGELL. So that you could give the same emphasis or slightly less emphasis?

Mr. LEFFLER. We will see to it that it does give greater emphasis to the program. That is the only criterion we are using.

Mr. DINGELL. I, as you know, am a duck hunter and I spend considerable time hunting. Some of it was spent in my colleague's area, Mr. Cederberg. I found in our State that your cooperative arrangements with the State game and fish people worked very well, but I am wondering this—are you utilizing part-time people to increase the number of Federal enforcement officers you can have in the field?

Mr. LEFFLER. We do have during the course of the year quite a number of part-time people, or temporary employees. A great many of those are in the Alaska area, but we do have a few in the United States.

Mr. DINGELL. This would bring your stateside enforcement force to approximately what number during the duck season?

Mr. LEFFLER. That will be covered thoroughly Tuesday.

Mr. DINGELL. I will defer the question until Tuesday.

During the forthcoming year do you expect to undertake some research on the effects of insecticides and pesticides on fish and wildlife?

Mr. LEFFLER. Yes.

Mr. DINGELL. That presents a substantial problem.

Mr. LEFFLER. It is a real problem because we do have the effects of the use of insecticides, pesticides, and so forth, on fish and wildlife, both on the sports side and on the commercial side. We have on the other side the destruction to our forests, and so forth, so the matter is going to require a great deal of cooperative work between the Department of Agriculture and ourselves and some of the outside agencies such as the Conservation Foundation who are undoubtedly going to work with us and try to arrive at some workable plan whereby we can take care of the damage being done, as well as protect the fish and wildlife. There are some phases of this that are giving us a great deal of concern.

Mr. DINGELL. One of the things I have been concerned about is the land acquisition program that you people have under the Duck Stamp Act and other programs. There is a drainage program that competes with that.

Mr. LEFFLER. You are speaking of the so-called wetlands program?

Mr. DINGELL. The wetlands drainage program of the Department of Agriculture. As fast as the Department of the Interior is able to buy the refuge land to increase our wildlife production we find that the same land, or similar land, is being drained. Am I correct?

Mr. LEFFLER. I would like to answer your question this way: We are not unmindful of the seriousness of this problem and we are prepared to give you on Tuesday a pretty thorough picture of the situation across the country.

Mr. DINGELL. I would just like to close by complimenting you, Mr. Secretary, on the fine job you have done since you have been in this office. I think you are a credit to the country and the service itself.

The CHAIRMAN. Mr. Mailliard.

Mr. MAILLIARD. I have no questions.

The CHAIRMAN. You have no further statement?

Mr. LEFFLER. I have no further statement.

The other point that I would ordinarily comment on we have prepared to place before the committee with the two Bureau Chiefs, and we have made arrangements to give you slides rather than holding a chart up to give you a complete picture of what we are doing and what we hope to do.

The CHAIRMAN. During the remainder of this fish and wildlife review you contemplate being with us so if anything controversial comes up we can call you back?

Mr. LEFFLER. That is correct, sir.

The CHAIRMAN. We will then proceed with the program as you have outlined it. We will take the next witness and we thank you for your statement and appreciate it very much, Mr. Secretary.

STATEMENT OF DONALD McKERNAN, DIRECTOR, BUREAU OF COMMERCIAL FISHERIES, DEPARTMENT OF THE INTERIOR

Mr. MCKERNAN. Mr. Chairman and members of the committee, my name is Donald McKernan, and I am the Chief of the Bureau of Fisheries.

Since this is the first opportunity I have had to discuss the commercial fisheries program of the United States with this committee, perhaps it is apropos if I give you just a brief word about my own background.

The CHAIRMAN. I think that would be fine.

Mr. MCKERNAN. I am a graduate of the University of Washington's School of Fisheries and have been a resident of the Pacific Northwest for a great share of my life. I was a practicing fishery research biologist for both the State of Washington and the State of Oregon, and assumed the position of Assistant Director and Chief of Research and Development for the Fish and Wildlife Service's Pacific Oceanic Fsheries Investigation, the investigation Mr. Allen spoke of. After that assignment I became Administrator of Commercial Fisheries for the Service in the Territory of Alaska, the position I held until my recent assignment as Director of the Bureau of Commercial Fisheries.

I have also been a fisheries expert for General MacArthur in Japan after the last war, and I taught at the University of Washington's School of Fisheries for 1 year on leave of absence from the State of Oregon.

Mr. Chairman, there are two possibilities for proceeding here this morning. I am anxious to do it in the way that will facilitate the committee's time. Mr. Zinke indicated to us that he wished to have discussed acts authorizing fisheries activities in the last 10 years, and in addition to that, to supplement those remarks, we have quite a number of slides which describe the activities of the Bureau, both with reference to these particular fisheries acts and also with respect to other phases of our development program.

Now, for the remainder of the morning I would be glad to discuss these specific acts and the functions of the Bureau as carried out under these acts, or I would be pleased to start right in on the slides and to discuss the various phases of our activities, giving a little background about the commercial fisheries of the United States, just anyway that you desire.

The CHAIRMAN. Well, the committee desires to be informed of your functions and what is being done and what has been accomplished. I might say for myself that I am anxious to have this record show the number of studies that have been farmed out to institutions, and what result has come from these studies.

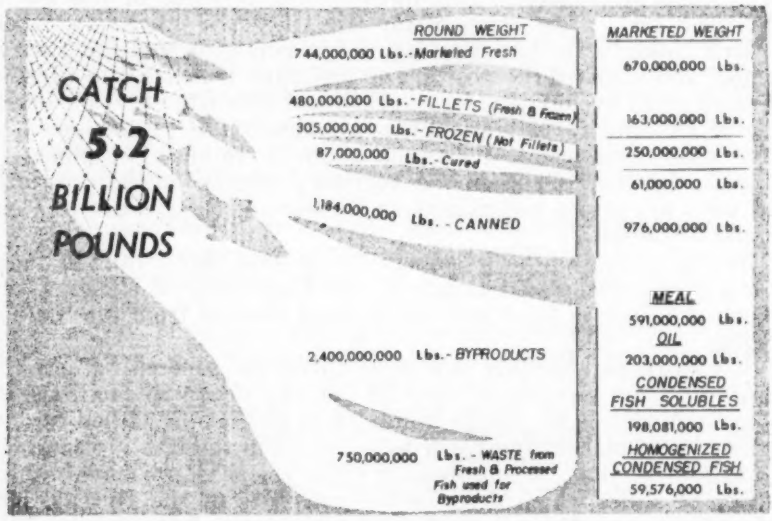
So, you proceed as you desire to bring us up to date on just what this new Commercial Fisheries Bureau now has done, and is going to do.

Mr. McKernan. I will be pleased to do that, Mr. Chairman, and before starting with the slides, I would like to refer you to the booklet or digest material that we have prepared for you.

The first page is a table of contents, giving such things as fishery legislation during the last 10 years, various special studies and biological research, many of which relate to the special acts authorized during the past 10 years, statements concerning our industrial research and services, our Division on Resource Management, and also a rather complete breakdown of the Saltonstall-Kennedy Act, and the programs and projects that are allotted under that particular act, including a summary of the contracts we have out with universities, the subject that you just touched upon.

With that brief introduction, then, perhaps, I might proceed with the slides and discuss the matter of commercial fisheries. I will be glad to answer any questions as I go along, or whatever suits you gentlemen.

FLOW CHART of the COMMERCIAL FISHERIES - 1956

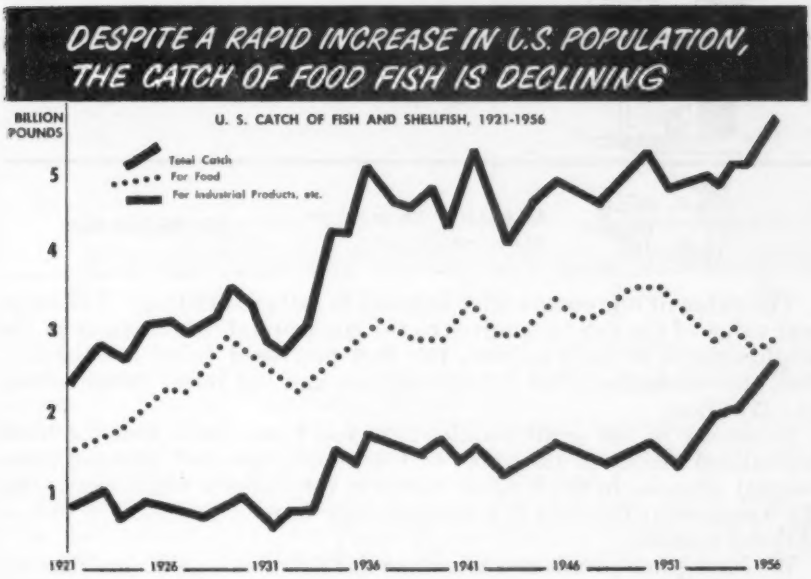


NOTE.—The round and marketed weights shown above do not include imported items processed in the United States. The marketed weights listed do not include fresh bait, fresh animal food prepared from waste, shell products, or other miscellaneous byproducts.

The 1956 act—the Fisheries Act of 1956—provided for a national fisheries policy that was rather clear. In other words, Congress spelled out rather clearly that it was the national commercial fisheries policy to increase and maintain forever for the people of the United

States a fisheries resource capable of allowing the maximum annual product, and to strengthen and to maintain a vigorous fishing industry by assuring full and fair access to its raw materials and full and fair access to the American markets, and to do these things in participation with the States and in full accordance with our international obligations.

It is under this mandate of Congress that our Bureau has developed its commercial fisheries program, and the following activities as clearly as possible follow this particular national fisheries policy.



This [indicating] is a graph showing the increase in the total domestic fisheries production in the United States which during 1956 was about 5.2 billion pounds.

The industrial fishing—the very bottom light blue figure—shows that the use of our commercial fisheries for industrial purposes has increased during the past few years, while the commercial fisheries used for food fish production has decreased. This is somewhat alarming to us, and especially upon further analysis we find that this increase in the industrial fish is primarily the increase in the use of menhaden on the east coast here, and especially in the mid-Atlantic States.

ESTIMATED VALUE OF FISH AND FISHERY PRODUCTS AT PRODUCTION, PROCESSING, AND DISTRIBUTION LEVELS 1956

The ORIGINAL value of fish and shellfish as taken from the waters was **$363,000,000**

When PROCESSED the value was **$612,000,000**

After WHOLESALE distribution the value was **$865,000,000**

And when RETAILED to the consumer the value was **$1,128,000,000**

The value of our commercial fisheries is rather startling. The original value of the fish themselves to the commercial fisherman is in the neighborhood of $363 million, the first processed value is $612 million, the wholesale value is $865 million, and the retail value is over $1.125 billion.

Summary in the small booklet that you have shows that the total capitalized money or the value of the plants, nets and boats of commercial fisheries in the United States is very nearly $12 billion. So, the commercial fisheries is a substantially important industry in our national economy.

We have some problems in commercial fisheries—problems that we are evaluating rather carefully.

We find from 1930 to 1955 the per capita consumption of fishery products in the United States has remained rather constant—from 10 and 11 pounds per person per year. During this same time, of course, our economy has increased, and with reference to other food commodities such as meat products, the per capita consumption has increased with the per capita income of our population. Yet, our fishery products have not. We are evaluating that particular phenomenon with the idea of attempting to assess exactly why the fish consumption has remained at a relatively low level, whereas other basic foods within our economy with reference to consumption per person has increased.

We believe, as you will see as we proceed, that one of the major factors is the matter of quality and the matter of distribution of our fishery products.

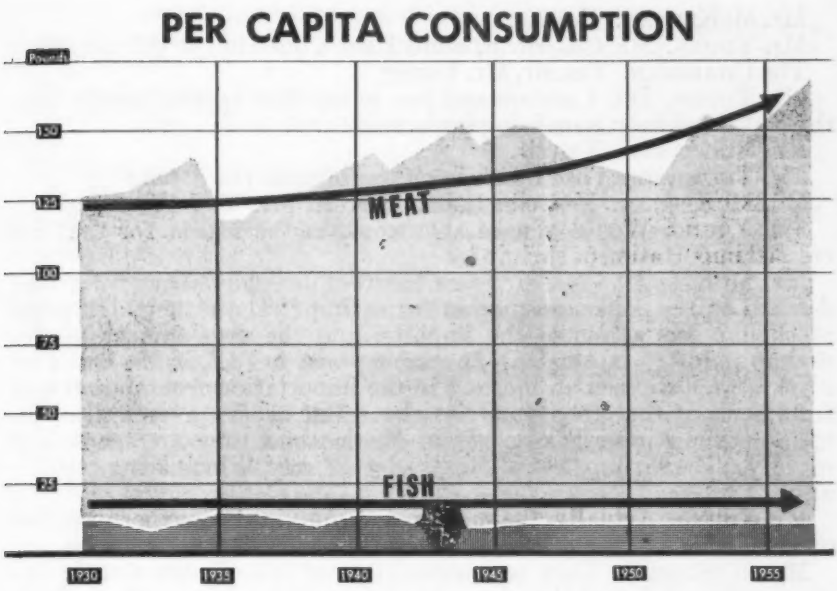
Mr. GROSS. Mr. Chairman, might I ask a question at this point with reference to the other chart which he has just covered?

The CHAIRMAN. Yes, Mr. Gross.

Mr. GROSS. Is that domestically produced fish?

Mr. MCKERNAN. This was the total consumption of fishery products, domestic, plus imports.

Mr. GROSS. Plus imports?



Mr. McKernan. Yes, sir. The total per capita consumption. Now, that means that the total consumption, of course, within the United States, Mr. Gross, has increased substantially.

Mr. Gross. That is what I thought. I could not understand how consumption had not increased with frozen fish and other fishery products being offered as they are now offered in the stores.

Mr. McKernan. One of the first graphs, you may recall, showed that the production of our food fish itself had been declining during the last 5 years. On the other hand, we have had an increase in the importation of fishery products which, in a sense, means that the total volume of fishery products within the United States has actually increased, but the per capita consumption has maintained this constant level.

Is that satisfactory?

Mr. Thompson. What percentage of the consumption of fish would you consider would be imported fish?

Mr. McKernan. It varies greatly, Mr. Thompson, with the species involved.

In the case of shrimp, for example, and an important species in your particular area, it is running very close to one-third. One-third of the shrimp products are imported now primarily from Mexico. In the case of tuna, for example, it is about one-half. In the case of fish fillets, for example, it is considerably more than half at the present time.

Mr. Thompson. Would you say that in total money value as much as 40 percent of the value of the fish consumed would be imported fish?

Mr. McKernan. Mr. Anderson informs me it is closer to one third for edible and inedible products.

Mr. Thompson. Which is a high figure, considering the resources we have.

Mr. McKERNAN. Yes, sir.

Mr. YOUNG. Mr. Chairman, could I ask a question at this point?

The CHAIRMAN. Yes, sir, Mr. Young.

Mr. YOUNG. Did I understand you to say that approximately one-third of the shrimp were being imported?

Mr. McKERNAN. Yes, sir.

Mr. THOMPSON. That figure is on the increase; is it not?

Mr. McKERNAN. Yes, sir; that is correct, Mr. Young.

Mr. YOUNG. Would you be able to assess the reason for that increased importation of shrimp?

Mr. McKERNAN. Yes, sir; this has been brought about by a real demand on the American market for shrimp. The rather high price of shrimp has attracted the imports, and the development of the shrimp industry in Mexico. In recent years, in fact, in the last 1 or 2 years we have seen an increase in the importation from Japan and from some of the other countries also. But at the present time the major shrimp imports come from Mexico and they are increasing rapidly. The shrimp fleet of Mexico, by the way, is increasing rapidly also.

Mr. YOUNG. Actually, the supply of shrimp in the northern reaches of the gulf are in the process of diminishing; is that not a fact?

Mr. McKERNAN. This year especially we saw a very drastic decline in the catch and abundance of shrimp in Louisiana, Mississippi, Alabama; there was an increase in catches, however, and a rather stable level of production in the more eastern States, for example.

Mr. YOUNG. Excuse me for a minute; I did not mean to interrupt you, but you might state—that is, in Texas—actually that catch is made down in the area of the Gulf or Campeche and in the northern reaches of the gulf?

Mr. McKERNAN. Mr. Young, I believe the shrimp catch right off Texas itself was fairly good this year, and was quite different from the neighboring State of Louisiana, something that our scientists have not been able to explain to us satisfactorily yet. But the white shrimp, for example, was the one in such a state of decline in Louisiana, Mississippi, and Alabama.

Mr. YOUNG. But that same species was rather abundant in Texas?

Mr. McKERNAN. Yes, sir. This tends to substantiate some of the scientific theories that the fluctuations in the white shrimp catch—the fluctuation that we have seen in the past few years—have been to a considerable extent due to changes in the natural environment rather than such things as overfishing. This has not been proven yet, but it is a hypothesis that scientists have put forward in very recent months.

Mr. YOUNG. In recent years, I think you would agree with the general statement that we are in great need of a great deal of expenditure in experimentation with the shrimp situation in the gulf to determine what is going on with the shrimp.

Mr. McKERNAN. Very much so, and I certainly intend to dwell on that further, because I know it is of interest to those of you from down there.

The CHAIRMAN. Mr. McKernan, permit me to ask you a question at this point.

Mr. McKERNAN. Yes, sir.

The CHAIRMAN. Is the increased importation of fish products due to our fishermen catching less fish and the depletion of fish in their fishing areas?

Mr. MCKERNAN. No, sir.

The CHAIRMAN. It is due to the increased demand for fishery products?

Mr. MCKERNAN. It is because the American market is the best market in the world. Our fisheries industries have developed really phenomenal markets for such things as salmon, tuna, shrimp, and other commercial species.

The frozen fillet industry, for example, is now gaining steadily. This market is extremely attractive to countries wanting American dollars, Mr. Chairman.

The CHAIRMAN. How does our increased production compare with the increased demand?

Mr. MCKERNAN. The increase in production is not maintaining itself with respect to the demand primarily because even though there is an increased demand for fisheries products, it is being satisfied with increased imports of fish which can sell on the American market more economically than our own.

As an example, the frozen fillets that come in constantly undersell our fillet production. The canned salmon from Japan constantly undersells our salmon. The canned tuna in brine that comes in with a very low tariff can undersell our tuna for as much as 10 cents a can. A part of this, of course, is due to the difference in labor costs, and the same technological advancements that have taken place in these countries.

For example, Iceland has all the latest Baader filleting machines. In fact, they have more in their industry than our New England industry does. So, that to my way of thinking, then, this amounts to a difference in the cost of production in the two countries, allowing these countries to come in and successfully compete with our fisheries to the extent that our own fishermen are hard pressed to maintain the same standard of living as other segments of our economy.

The CHAIRMAN. Is there any differential in quality?

Mr. MCKERNAN. In some fisheries the quality of our own product is quite superior. In other fisheries, especially those that have been subject to importation for some years, such as in the New England fillet industry the quality has suffered because of lack of capital to replenish equipment in the plants, and to hold the fish properly and to buy and sell properly.

The CHAIRMAN. You may proceed.

Mr. PELLY. Mr. Chairman, might I ask a question?

The CHAIRMAN. Yes, Mr. Pelly.

Mr. PELLY. Would you state for the record the ratio of imports as against domestic salmon catch?

Mr. MCKERNAN. Yes. I believe that the importation of salmon in the last 2 years or so has been in the neighborhood of one-half million cases, and our own production has been less than 4 million cases. I will apologize if these figures are only approximate.

Mr. PELLY. Does that include both canned and frozen fish?

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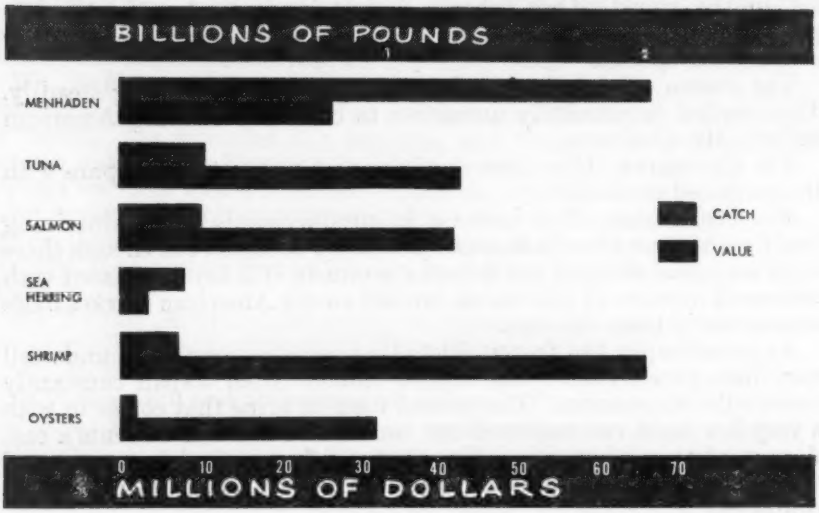
Mr. McKernan. There were 13 million pounds of fresh and frozen salmon brought into the United States in 1956. They are all canned.

Mr. Allen. Mr. Chairman, I would like to ask a question at this point.

The Chairman. You may proceed, Mr. Allen.



Mr. Allen. Mr. McKernan, on the chart you show the six varieties of fish. It seems to me that the menhaden in the South Atlantic, tuna on the west coast, shrimp and oysters on the gulf coast and part of the west coast are very important segments of the economy of that particular area. Do those financial bars there to some extent indicate the interest of the various regions in the fishing industry as a whole?

Mr. McKernan. Yes, sir, Mr. Allen. I believe that that is one way to evaluate the interest of the regions in commercial fisheries.

Mr. Allen. Thank you.

Mr. Gross. Mr. Chairman, I would like to ask a question at this point.

The Chairman. You may proceed.

Mr. Gross. Would you tell me what you mean by "menhaden"?

Mr. McKernan. That is the small herring-like fish of the east and gulf coast. The heaviest catch is from the Middle Atlantic States, and also now the catch in the Gulf of Mexico is growing. It is a fish that is caught and is reduced into fish meal and fish oil. It produces very valuable meal that is used as a supplement in both poultry and livestock food, and it produces oil which is used very extensively for industrial purposes where a low melting point liquid oil is required such as for precision instrument, paints, and such things as that.

I have a little more coming on that subject of menhaden as we go through this, Mr. Gross.

You will notice that menhaden is the No. 1 commercial fishery of the United States. Salmon follows, and sea herring is an important

species, as well as shrimp and oysters. Valuewise, the distribution of commercial fisheries is somewhat different with shrimp being the most valuable.

The amount of dollars at the bottom of the chart for shrimp—the orange bar, for example—is approximately $70 million to the shrimp vessel. This is the value to the fishermen themselves in all cases, shrimp is followed by tuna, salmon, oysters, menhaden, and sea herring.

These are simply examples of some of our major fisheries and by no means are meant to imply that they are the only important fisheries within the United States.

Mr. BOYKIN. I wonder how Iceland could afford to have such fine machinery and New England could not. Could you explain that?

Mr. MCKERNAN. Well, fishing is by far the major industry in Iceland. In fact, it is the bread-and-butter industry, and it certainly gets the major emphasis in such things as direct aid from its Government.

Mr. BOYKIN. From its Government?

Mr. MCKERNAN. Yes, sir; and probably loans that the United States has made to Iceland to a considerable extent have gone into the modernization of their fisheries plants. Some of their very latest fillet machines may have been brought in indirectly by money which has been loaned by the United States.

Mr. BOYKIN. That is what I was afraid of. I wonder if we could not loan New England some money to compete with them by getting the proper machinery? There is no way to compete as the situation exists today.

Mr. MCKERNAN. Mr. Boykin, I believe this Congress will be faced with some legislation from New England, perhaps, to do just exactly that very thing.

Mr. BOYKIN. That seems a shame to me.

Mr. Chairman, we ran into that when you sent us to Europe—especially this group here—and also with reference to Japan. We asked the people why they did not buy the steel from us over here. They were buying it from Japan because they had the best steel mills, and we found they furnished all the steel.

The CHAIRMAN. It is—is there not to be considered in this the cost of production as between Iceland and the States—the cost of catching the fish?

Mr. MCKERNAN. Yes. You are asking me to comment on that subject?

The CHAIRMAN. Is there not something to be considered in that respect?

Mr. MCKERNAN. There certainly is.

The CHAIRMAN. I have reference to the cost of catching the fish.

Mr. MCKERNAN. Yes; that is right. I will discuss, for example, this matter of New England fisheries. I have checked on 1 or 2 fisheries such as the New England situation, and the tuna situation in the north Pacific as well as the salmon situation, and have a few slides to indicate why our costs are considerably higher.

The CHAIRMAN. You are coming to that later in your presentations?

Mr. MCKERNAN. Yes, sir.

Mr. BOYKIN. Mr. Chairman, I have just one more question at this point.

The CHAIRMAN. You may proceed, Mr. Boykin.

Mr. BOYKIN. The equipment has a lot to do with it also, of course. The equipment they have to catch the fish with has a great deal to do with the cost involved; does it not?

Mr. MCKERNAN. Yes, sir, Mr. Boykin.

Mr. BOYKIN. I suppose we have furnished money for that, too, perhaps?

Mr. MCKERNAN. Possibly in indirect ways we have.

Mr. GROSS. Mr. Chairman, I have a question at this point.

The CHAIRMAN. You may proceed.

Mr. GROSS. Did we not give some of these countries sonar equipment for the detection of fish?

Mr. MCKERNAN. Yes; we did, although I am not too familiar with that.

Mr. GROSS. Do you know of any American fishermen who have been given sonar equipment?

Mr. MCKERNAN. No, sir; I do not.

Mr. RAY. Mr. Chairman?

The CHAIRMAN. Mr. Ray.

Mr. RAY. Are you going to develop in your later discussion the effect of the tariff in respect to Iceland and the New England situation?

Mr. MKERNAN. Yes; and at that time, if I have not answered it to your satisfaction, I will certainly be pleased to attempt to do so.

Mr. DINGELL. Mr. Chairman, I would like to ask a question at this point.

The CHAIRMAN. You may proceed, Mr. Dingell.

Mr. DINGELL. Is it not a fact that the New England situation is a rather peculiar one because the people up there have actually overfished some of their traditional fishing grounds?

Mr. MCKERNAN. Mr. Dingell, this has been true to some extent, but in recent years with the International Commission for the Conservation of North Atlantic Fisheries, a commission composed of, I believe, some 11 nations, there has been a very active research program—conservation program—developed, and as a result of that regulations have been imposed by the several nations involved and at the present time our scientists indicate that, for example, one of the major species, haddock, is in better condition now than it has been for many years, and that we are fishing very close to the optimum substantial yield on our own local banks, and George's Bank right off the coast.

While I think there was a period of overfishing in New England, I do not believe that to be one of the major factors affecting the New England fisheries at the present time.

Mr. DINGELL. What is the situation with reference to sea perch and rosefish?

Mr. MCKERNAN. There is no indication that—or I should say that there is no clear indication that there has been overfishing of these particular populations.

Mr. DINGELL. But they have declined, and our fishermen are taking smaller fish by a long shot than other fisheries in other countries are.

Mr. MCKERNAN. There are some reasons for that, too. In the first place, the rosefish production actually increased, apparently due to the gradual change in fishing areas occurring in New England. Now, in very recent years there has been some decline in size, but rosefish production is still pretty good.

There is a decline in the average size, but I would remind you that whenever a fishery begins to operate, the fish do decline in size. This does not mean depletion. This simply means fishing closer to a point of stabilized production and then, of course, if fishing continues beyond that point, depletion sets in.

Mr. DINGELL. Well, are not some fisheries going beyond this point of optimum production?

Mr. MCKERNAN. That is correct.

Mr. DINGELL. This is one of the real problems of that picture that besets the American fisherman. They are taking a lot more fish than is good for the fisheries. I am thinking now about the local fishing conditions right here in the Chesapeake Bay and along the Atlantic coast. That is a very real problem; is it not?

Mr. MCKERNAN. I am sure that is, but we have been carrying on studies with the striped bass—you may call them rockfish—on the Atlantic coast, and we do not find any indication that there has actually been overfishing.

For example, there seems to have been a very successful year at least with reference to rockfish, and the scientists of our Bureau are now predicting quite an increase in the striped bass production this coming year, for example.

Mr. DINGELL. It is my recollection that in 1 year not too long ago in the same area of Chesapeake Bay they just murdered the rockfish. They caught practically 2 or 3 years' catch in 1 year. I forget which year it was, but it did take place.

Mr. MCKERNAN. There is no question about the fact that unwise utilization can overharvest and reduce stocks of fish. Wise utilization can bring about a sustainable maximum yield which will not be harmful.

Mr. DINGELL. This is one of the problems I think that you have in some parts of the country in regard to taking shrimp also; is it not?

Mr. MCKERNAN. There is no scientific evidence that there has been overfishing of shrimp. Shrimp are a species that go clear through their life history anywhere from 1½ years to 2 years. Furthermore, the mortality of the eggs and young is probably in the neighborhood of 99.1 percent. So, the effects of the fisheries on this particular species does not seem to be as much as changes in the environment itself.

Mr. DINGELL. One other thing that comes to my mind is this: We find that they have a tremendous increase in the number of vessels out doing the catching, but our actual production has increased very slightly; has it not?

Mr. MCKERNAN. That is right.

Mr. DINGELL. The result is we have a tremendous number of people fishing the same banks, and taking the same number of fish, but one of the real problems the American fisherman faces is that there are too many fishermen for the resources they are presently fishing?

Mr. MCKERNAN. I should have said a moment ago a qualified "that is right," because I think you will see from our figures that we are actually losing fishing boats at a great rate. There may have been a time—and there was a time in most of our commercial fisheries, as there is in many of our business enterprises where there is an over-

development of the fishing gear, and fishing methods, but this is not the case now in most instances.

In New England we have lost far too many boats, in my opinion. In the tuna fisheries industry we have lost about one-third of the large boats.

Mr. DINGELL. But, there were really too many over on the west coast; were there not?

Mr. MCKERNAN. No; I do not agree with that. In fact, I suspect that the tuna resources could stand a great deal of expansion at the present time. The skipjack stocks, based upon our scientific studies, could stand considerable expansion of the present catch. The point I have been leading up to is this——

Mr. DINGELL. Are you people making any study on controls for the number of fishermen and adequate regulations, both State and Federal, for the conservation of these fish stocks so that these people will not overfish?

Mr. MCKERNAN. All of our studies have that as one of our objectives; all of them.

Mr. DINGELL. With reference to salmon, are you going to study the impact of these high dams of anywhere from 500 feet to 700 feet, which are being constructed on the various rivers?

Mr. MCKERNAN. Yes, sir; I have some slides on that, and will go into detail with reference to it.

Mr. DINGELL. I understand there is a serious situation on the Columbia River system such as the Nez Perce Dam and other dams of anywhere from 500, 600, and 700 feet, where you cannot get the salmon up over the dams.

Mr. MCKERNAN. Yes, sir.

Mr. DINGELL. Those dams also will shut off other fish; will they not?

Mr. MCKERNAN. Yes, sir; they will.

Mr. DINGELL. Thank you very much, Mr. Chairman.

Mr. MCKERNAN. We are doing other things to attempt to ameliorate the damage due to those particular high dams on the Columbia River and other west coast and Pacific Northwest rivers.

Mr. DINGELL. But you do not know presently of any way whereby you could get a salmon across one of those high dams?

Mr. MCKERNAN. We do not know of any way that we can assure that the runs can be maintained past these high dams. We are trying very hard to solve that particular problem.

Mr. DINGELL. According to present scientific information, if these dams go up, it will not be possible for salmon to go up the tributaries of the Columbia River; will it?

Mr. MCKERNAN. I believe that goes farther than I would be willing to go, because I am sure that artificial propagation has proceeded to the point where there will be a maintenance of some runs in the lower reaches below the point where it is not economical to put the dams, but nevertheless the substance of your statement is about right.

As major resources they may cease to exist if we cannot solve the problem.

Mr. DINGELL. But you would say more strongly that they will probably cease to exist at least in these particular tributaries, and probably in the whole streams as a result of these headwaters?

Mr. McKernan. No; we are making more progress in that regard, Mr. Dingell. Our program is rather substantial in finding ways to provide for these salmon to survive. I am not optimistic about our success, but there are considerable funds going into this study, and a great deal of progress has taken place.

For example, at the present time with the numerous dams on the Columbia River, some of these up-river runs are being maintained at the same level as they were in the past. I must admit this to be the case. It is the high dams that you spoke about that we are very much concerned about, and at the present time we are not optimistic about maintaining the runs at least in their present abundance.

Maybe propagation will continue, and there will be those that are strong enough to survive the rigors of whatever test we put to them with these high dams when they are constructed.

Mr. Dingell. But at the present time you do not hold much hope out for them if these dams go in the up-river runs?

Mr. McKernan. The answer is "yes," I do not hold much hope for them.

Mr. Dingell. Thank you, Mr. Chairman.

The Chairman. Is the heavy taking of what we call the commercial fish, the menhaden, diverting the edible fish to some other areas?

Mr. McKernan. No; I do not believe that is the case, but quite the contrary. I believe without the utilization of these species or the utilization of other more desirable food fish, the result might be just the opposite. We would have an imbalance in the environment if we did that, and we would do more harm than good.

The Chairman. As I understand it, the heavy fishing for shrimp does not offer a problem of depletion?

Mr. McKernan. No. Now, in general——

The Chairman. You said the shrimp develops in 18 months, or that the life of the shrimp is about 18 months?

Mr. McKernan. In general that seems to be the case as far as our research has gone thus far. We suspect, though, that in, maybe, certain very limited areas, there is overfishing of the very small shrimp, in inside waters but, in general, we have no evidence that fishing is the cause of these rather violent fluctuations.

The Chairman. What did you say about the mortality rate? Did you say it was about 90 percent?

Mr. McKernan. Yes. It is more than that. In fact, over 99 percent of the eggs that are spawned rarely reach maturity. They actually die both in the egg stage, and they serve as food for other species of fish, and others such as clams and other shrimps, and things, and during their larval stage that is a very vulnerable stage when they are subject to the winds and weather and storms.

The Chairman. Does the manner of taking shrimp affect other shellfish?

Mr. McKernan. Other species that are in the same environment?

The Chairman. The shellfish, or the fish over the oyster beds? Does it affect the reproduction of other shellfish?

Mr. McKernan. There is a great deal to be learned about this yet, Mr. Chairman.

The Chairman. Have I made myself clear?

Mr. McKernan. Yes; you have.

The CHAIRMAN. Does a particular type of trawling have anything to do with it?

Mr. MCKERNAN. Does it affect it?

The CHAIRMAN. Does it affect the reproduction of other shellfish?

Mr. MCKERNAN. As I started to say, there is a great deal yet to be learned about this, but where there has been trawling for hundreds of years of the sea bottoms there seems to be no decrease in the productivity; that is, in the ability to produce by those particular bottoms and this is one of the best evidences we have at the present time.

The CHAIRMAN. Of shellfish?

Mr. MCKERNAN. Well, in this case it is in the North Sea, and it is primarily fish.

The CHAIRMAN. I just want to get this matter clear in my own mind. I do not want to take up too much time, but the taking of shrimp in the area where other shellfish have heretofore been very plentiful seems to affect them. Is the diminution of other shellfish in any way connected with the taking of shrimp?

Mr. MCKERNAN. I do not know whether it is or not, but I could comment in this particular way, for example: I am fairly well aware of the need of oysters for proper environment. In one instance if the shrimp trawling stirs up mud which might settle on the oyster beds, then this would be a detriment to the oyster beds.

On the other hand, if the shrimp trawler stirs up the mud and it were sufficient to take this mud out of the areas, it might actually increase the production of oysters in those areas. There would not be so much silting because of stirring up the bottom.

There is another feature in the matter of trawling. These trawls themselves tend to stir up the bottom sediment, and in these sediments a great many of the minerals actually are present, such as the phosphates and other minerals which have fallen to the bottom with the dead, decomposed bodies of fish, and crustaceans and otherwise. There is some speculation among scientists that this increases the productivity in those areas.

The CHAIRMAN. Of what?

Mr. MCKERNAN. Of fish and shellfish, but, nevertheless, in spite of this, in certain circumstances it would seem to me that trawling would do some harm, and in other circumstances it might do some benefit. I do not think the full answer is really known to your question. I do not know whether I have helped you or not in that regard. However, I do not know whether I could give a more definite answer.

The CHAIRMAN. In an area where there is excessive trawling, would it not be wise to set aside specific areas there for other shellfish to have an opportunity to spawn and develop?

Mr. MCKERNAN. I believe each of those areas would have to be studied by themselves to see whether or not it would be necessary. In some circumstances it might actually do harm.

The CHAIRMAN. All right. You may proceed.

Mr. BOYKIN. Mr. Chairman, may I ask a question at this point?

The CHAIRMAN. Mr. Boykin.

Mr. BOYKIN. I do not know whether there is anything to it or not, but we went to Alaska about 20 years ago, and a good number of the members of this committee were on that trip. I believe it was in August, and we learned that they caught $50 million worth of salmon

that month. I thought that was an awful lot of money, then, but it is 10 times more than it is now.

While we were there we watched the salmon jump over and go over those little rises which they had there. Mr. Dingell's interrogation gave me this thought: Is there any chance of getting a little help to get these fish over these high dams?

For instance, if you have the water hit something like an escalator, it would give the fish a chance to get over the dams. I do not know whether there is anything to it or not, and I do not know if you could get them up over these dams.

Has any thought been given to such a method as that?

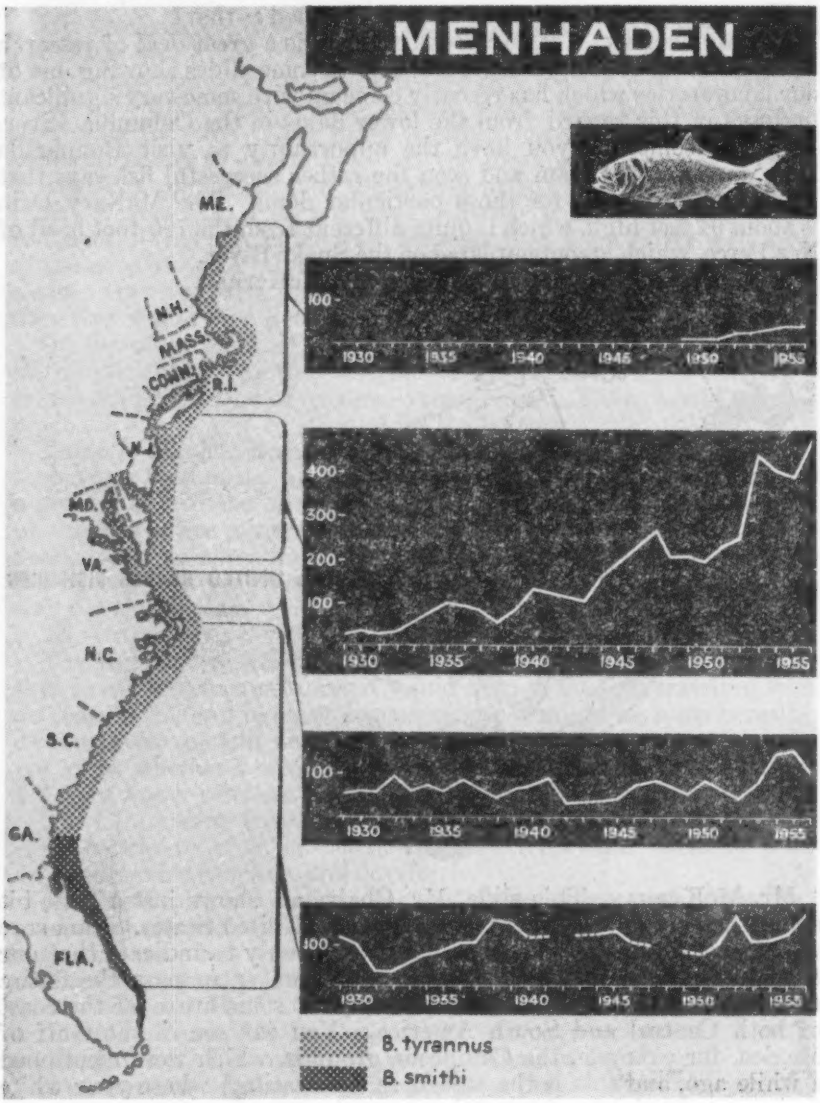
Mr. McKernan. Yes, Mr. Boykin, there is a great deal of research in this matter of fish passage, and I have some slides showing one of our laboratories which has recently come up with some very significant findings in this regard from the lower dams in the Columbia River.

I hope sometime you have the opportunity to visit Bonneville Dam and McNary Dam and seen the rather successful fishways that have been developed for those particular dams. The McNary Dam is about 94 feet high, which is quite different from the 700-foot head of Nez Perce, which is contemplated on the Snake River.

The Chairman. You may proceed, Mr. McKernan.

Mr. McKernan. This slide, Mr. Chairman, shows just a little bit about the general Continental Shelf of the United States. I am sure all of you are aware of this, and I show it only to indicate that our fisheries are generally widespread, and they encompass the entire coastline of not only the United States, but some areas off the coast of both Central and South America. You can see in the Gulf of Mexico, for example, the Campeche grounds, which were mentioned a while ago, and this is the area here [indicating] where your white shrimp production has been rather low this year.

There has been a very new and significant development of particular challenge to us and that is the pink shrimp in southern Florida that produces about 12 million pounds and is very important. These grounds in the northwest Atlantic are fished by nations of both Europe as well as the United States. These impoundments occur in the Great Lakes area, along the Mississippi, on the west coast, as well as in the Midwest. Many of these impoundments are in connection with fish programs and actually increase the environment available for more desirable sport fisheries.



Speaking of menhaden now, that has been the subject already of some discussion. This particular fish is taken from about Maine clear down to Florida, with the very heaviest production along the Middle Atlantic States. This [indicating] is the general picture of the fish. It is a herring-like fish and is heavy with oil and produces a very good quality of both oil and meal.

This [indicating] is the kind of boat which is used. The boat uses a surround net which has rings at the bottom, and after the fish are surrounded, these rings are pulled in tight, and in a sense a basket is formed and brought up with the fish.

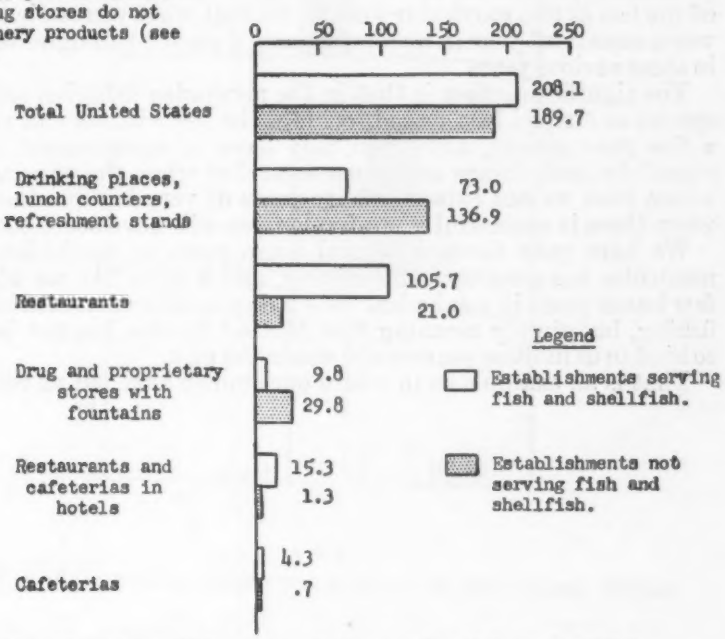
HIGHLIGHTS *

About 208,000 of the 398,000 public eating places in the United States serve fish and shellfish.

For restaurants as a single group, 21,000 or 17 percent of a total of 127,000 do not serve fishery products. However, 75 percent of the 40,000 drug stores do not serve fishery products (see table 3).

Distribution of establishments in the United States reporting whether or not fish or shellfish is served

(Number of establishments in thousands)



Six out of ten public eating places serving fish or shellfish sell more dinners prices at $1 or less than any other price range.

Seven out of ten public eating places serving fish or shellfish have cold storage space for keeping frozen fish and shellfish.

Two out of ten public eating places serving fish or shellfish are limited in the use of frozen fish or shellfish by lack of convenient or sufficient storage space.

* "Public Eating Places" as mentioned in the Highlights also include drinking places, lunch counters and refreshment stands.

The most modern of these boats are equipped with a big pump which sucks the fish into the holds of the boats. The method is very successful, and the investment in these boats amounts to several hundred thousands of dollars each.

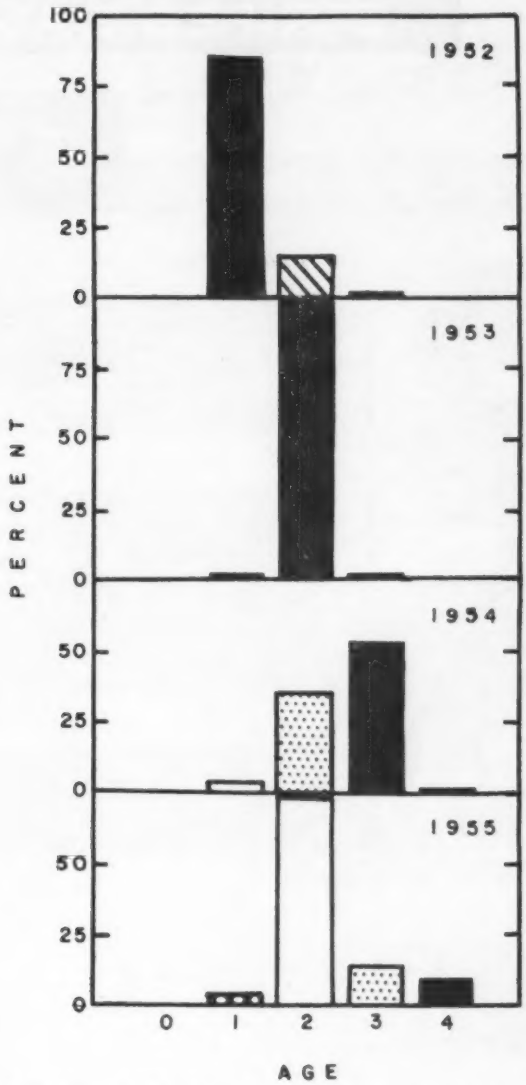
We have done quite a little bit from the standpoint of implementing the National Fisheries Policies enunciated by Congress, and here is an example of a study of public eating places that we carried out to provide data for the commercial fisheries as to where they might best put their promotional and advertising dollars. This [indicating] shows, for example, that almost half of the restaurants that have been sampled or surveyed do not serve any fish at all. We endeavored to point out areas where the consumption of fish might be increased tremendously with a relatively small amount of promotional cost. I am speaking of menhaden because I wanted to show you some of the findings that our studies have brought out about this particular fish, and to explain a little bit the fluctuations that we find in both menhaden and some of the other species, such as striped bass and others.

In 1957, for example, almost the entire Atlantic commercial catch was made up of 1-year-old menhaden; in 1953 almost the majority of the catch or haul or well over 80 percent, was 2-year-old fish. This [indicating] shows the same year group or the same time of spawning of the fish as this particular group. So that what you see is that there was a successful year in menhaden, and it passed through the fisheries in these various years.

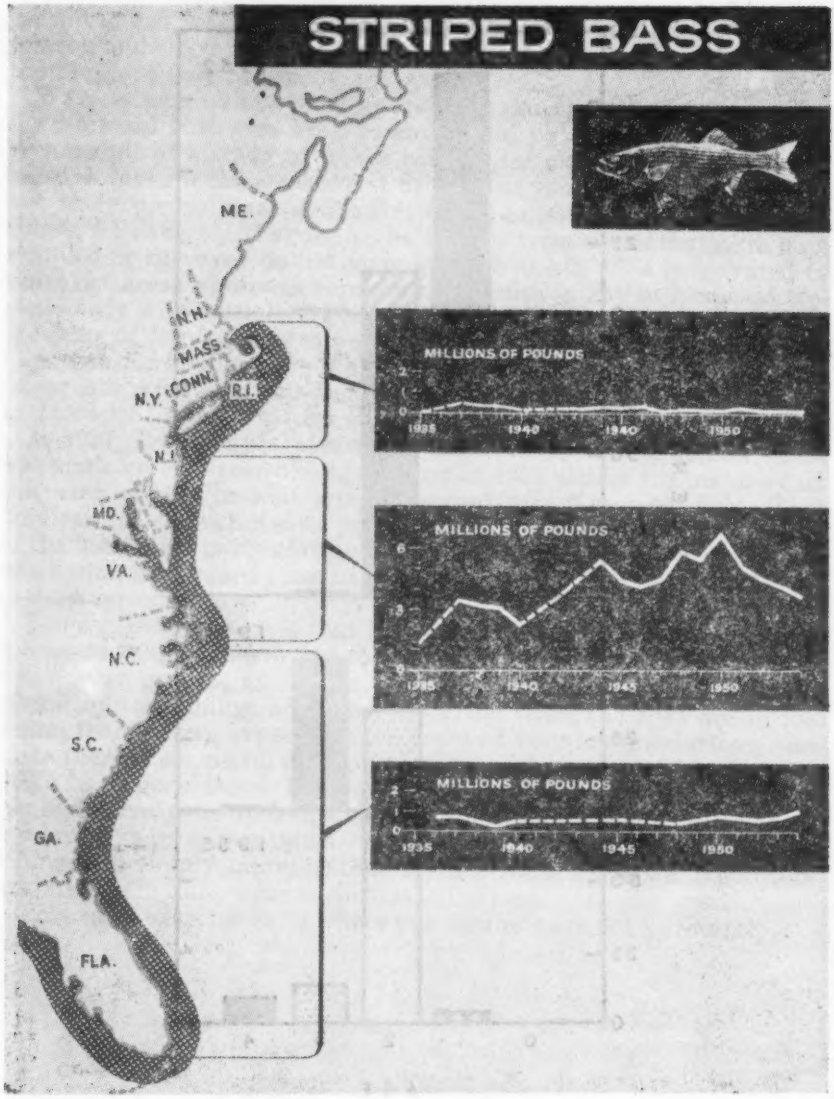
The significant effect is that in the menhaden fisheries, unlike such species as striped bass or red rockfish, the fisheries depend upon only a few year groups, and when they have an unsuccessful spawning caused by such things as storms occurring when the eggs are in the water, then we can expect to have years of very low production, and when there is successful reproduction, we will have some boom years.

We have gone through several boom years in menhaden and the menhaden has gone up tremendously, and it looks like we will have a few leaner years in menhaden. We interpret this as not meaning overfishing, but simply meaning that Mother Nature has not been quite so kind to us in those years as she was in the past.

That is an example as to where our studies have led us recently.



Age composition of the middle Atlantic menhaden purse seine fishery, 1952–55.

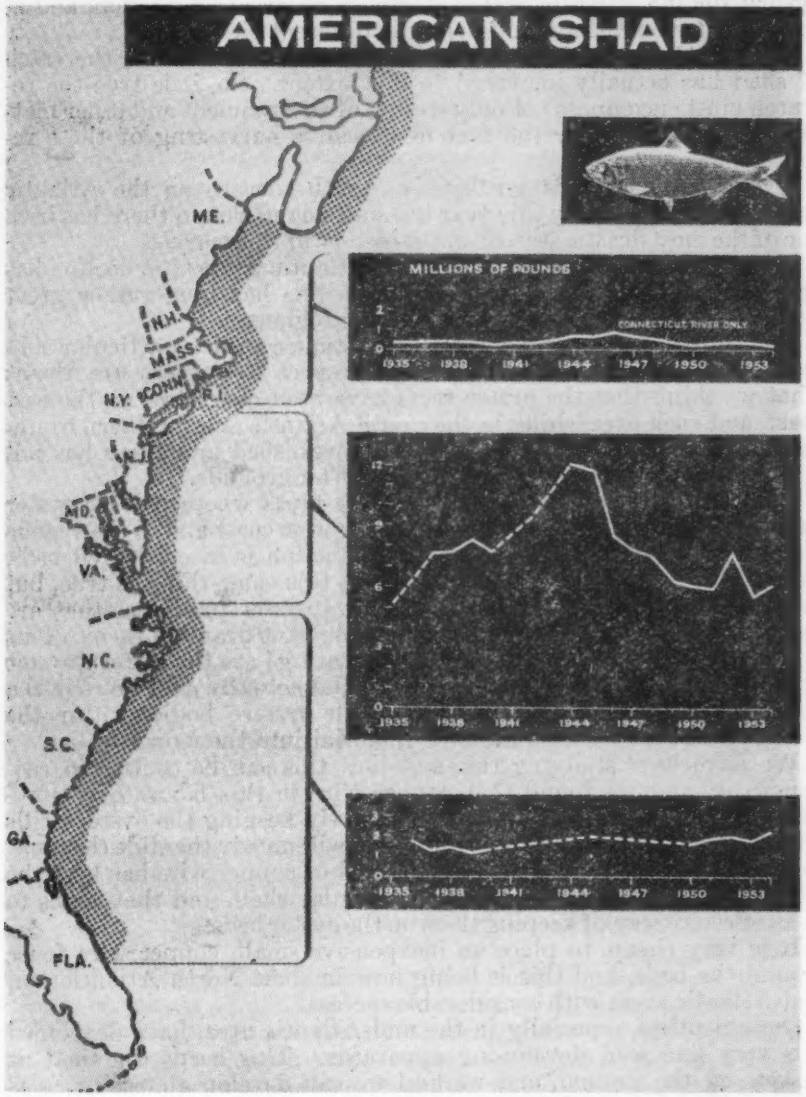


We have studied the striped bass along the Atlantic coast in both the Chesapeake and Roanoke areas, and this, for example, shows the general catch of the striped bass, how it fluctuates, how it reached a peak in 1950, and now is declining.

As Mr. Dingell mentioned, we expect, due to the rather successful year of striped bass several years ago, that this catch will now increase because these young fish are now entering both the recreational as well as the commercial fisheries.

Our studies are proceeding on striped bass both by direct appropriation as well as by allocations from the Saltonstall-Kennedy act, and these studies are finding what effect the industrialization along the Atlantic coast is having on them and how we can overcome this par-

ticular use of water, both as a sewer and also for industrial uses of water. This is an especially critical problem in the Roanoke area where we are attempting to work out ways of getting more oxygen for the striped bass in order to live in the waters. The studies are proceeding very satisfactorily. The study on the Roanoke has been going on for about 2 years.



The American shad production also depends upon fresh water environment all along our Atlantic coast. You can see where from the very early years of 1935 up to about 1945 we hit a peak and now we are coming down. Generally, this downward decline has been because of the decreased fresh-water environment; but not all of it.

In certain areas, as Mr. Dingell pointed out a few minutes ago, we have actually had overharvesting of these runs. In our research on both the Connecticut and Hudson Rivers—this, by the way, is within sight of New York—our research has shown that there was overfishing of the shad and the States have implemented research recommendations that our scientists produced, since we are the research agency for the Atlantic States Marine Fisheries Commission, and at the present time we have gotton quite a different picture.

Since 1950, when these regulations were put into effect, the catch of shad has actually increased to that extent. So, it is true the research must encompass not only studies of environment and other matters, but also consider the fact of excessive harvesting of these resources.

Oyster production is a subject of much concern on the Atlantic coast because especially this year in Long Island Sound there has been one of the most drastic seasons in the history of this market.

You can see also that in the North Atlantic States the decline has been rather disastrous. In fact, the decline has been rather great everywhere, except in the South Atlantic regions.

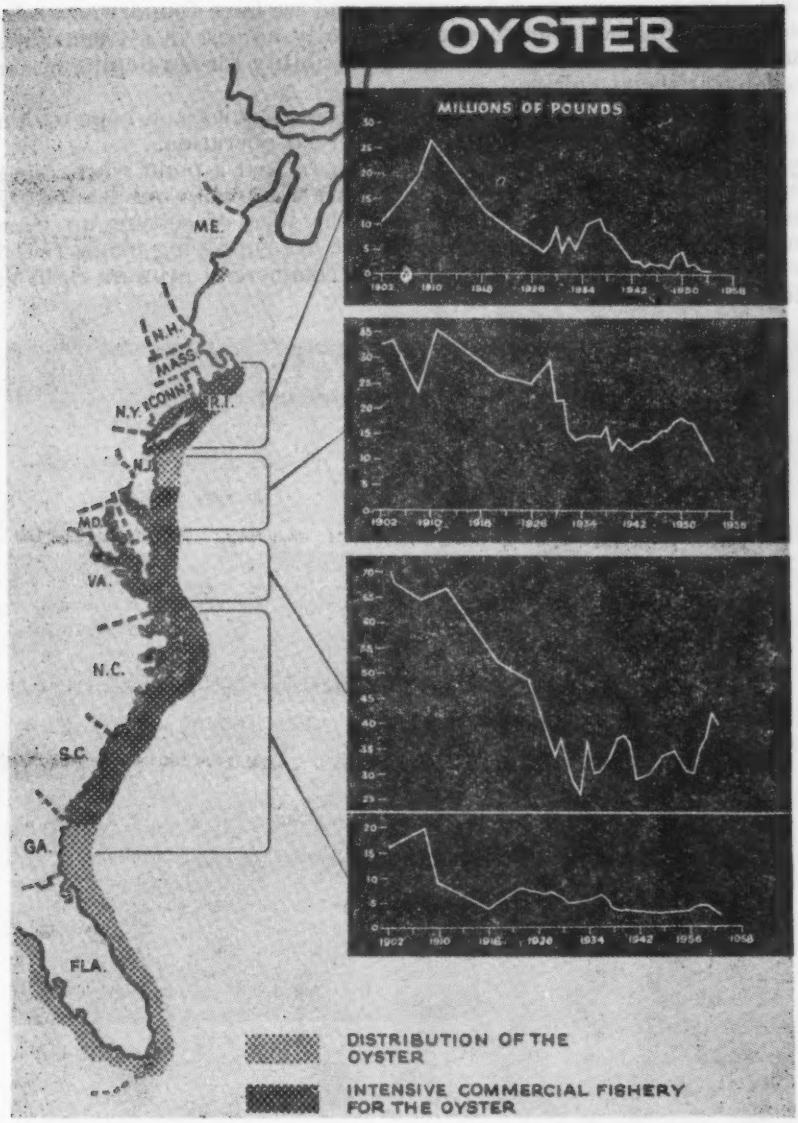
The Bureau is carrying out extensive studies on this particular subject. Our general conclusions with respect to oysters are these: That we think that the oyster reefs have been overfished on the east coast, and such overfishing in the South Atlantic and Southern States has not taken place. They have been overfished and there has not been the replenishment of these natural oyster grounds.

The States having the best success are areas where private oyster cultivation has come into the front on the west coast and in the Pacific Northwest almost all of the oyster production is in cultivated beds. On the east coast, and in the Gulf States this same thing is true, but there are other problems also. We have oyster predators that are devastating certain beds and causing a constant drain on them. This is a snail with a shell on it. These [indicating] are the eastern oyster drill. They get on these young oysters and actually drill holes in the shell and insert themselves and digest the oysters' bodies within the shells, and then suck this digested material into their own bodies.

We have been studying this and how this can be controlled economically, and we found that copper wire in this laboratory test—this thin band of copper wire—is effectively keeping the oyster drills from getting on the young oysters. You will note in the slide the number of small oysters. This very thin band of copper wire has kept the oysters from getting over on this particular shell, and that seems to be an effective way of keeping them on the oyster beds.

It is very cheap, to place an inexpensive small, copper wire fence around the beds, and this is being now in some North Atlantic and mid-Atlantic areas with considerable success.

Our scientists, especially in the mid-Atlantic area, have developed this very fine seed developing apparatus. This keeps the shell or baskets off the ground, and we find we can develop almost twice as many seed by this artificial means of support. This is a recent development, and is being adapted in eastern oystering, and we hope will help in the course of seeding.



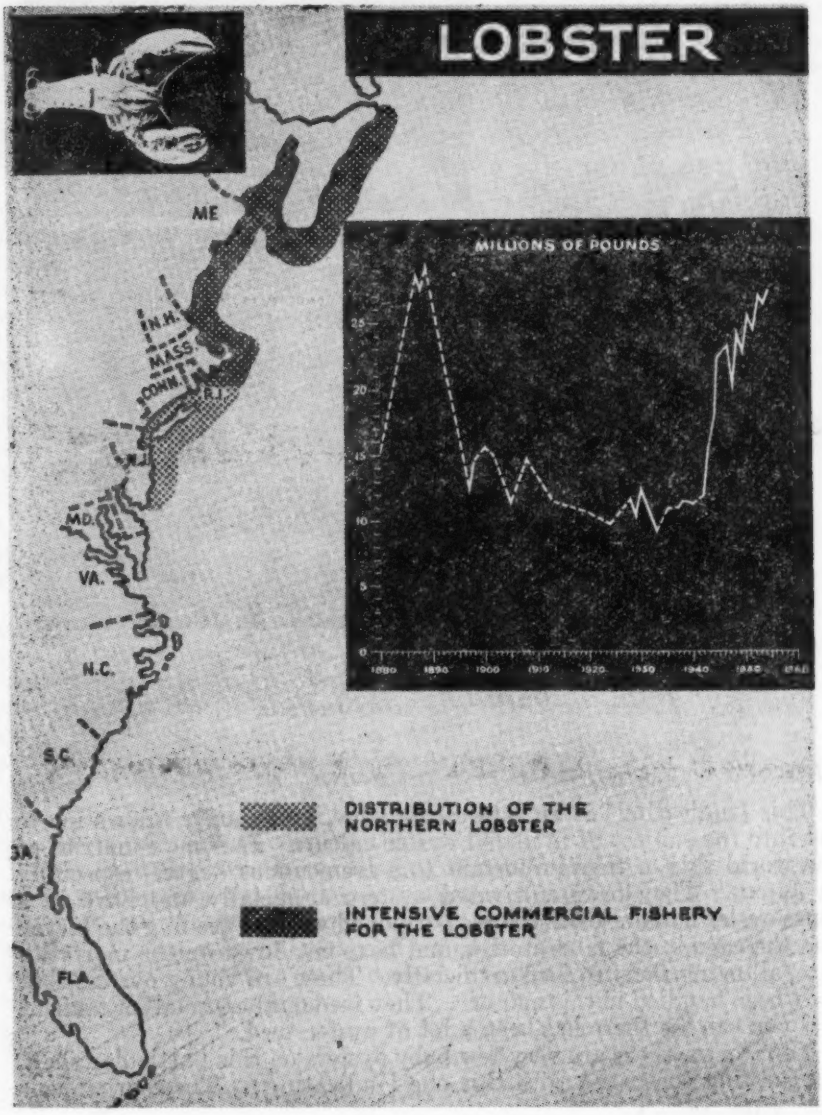
This [indicating] is an interesting slide, and simply allows me to get into the subject of artificial oyster culture. In some countries of the world this is very important to a tremendous degree, especially in Japan. They have cultivated oysters artificially and have in a sense oyster hatcheries, and have developed ways of feeding the larvae and the eggs in the laboratories, and have cut down on the mortality rate, allowing them to feed artificially. These are young oysters that have been handled in this manner. They feed on these small organisms and you can see there has been a lot of oyster feed.

You can see there are very few baby oysters on this particular shell, but nothing compared with this one [indicating]. These organisms

seem to be favorable food for oysters, and we have found we can develop those in the laboratory at practically no cost in a tremendous quantity and there seems to be a good possibility for developing oyster seed by artificial cultivation.

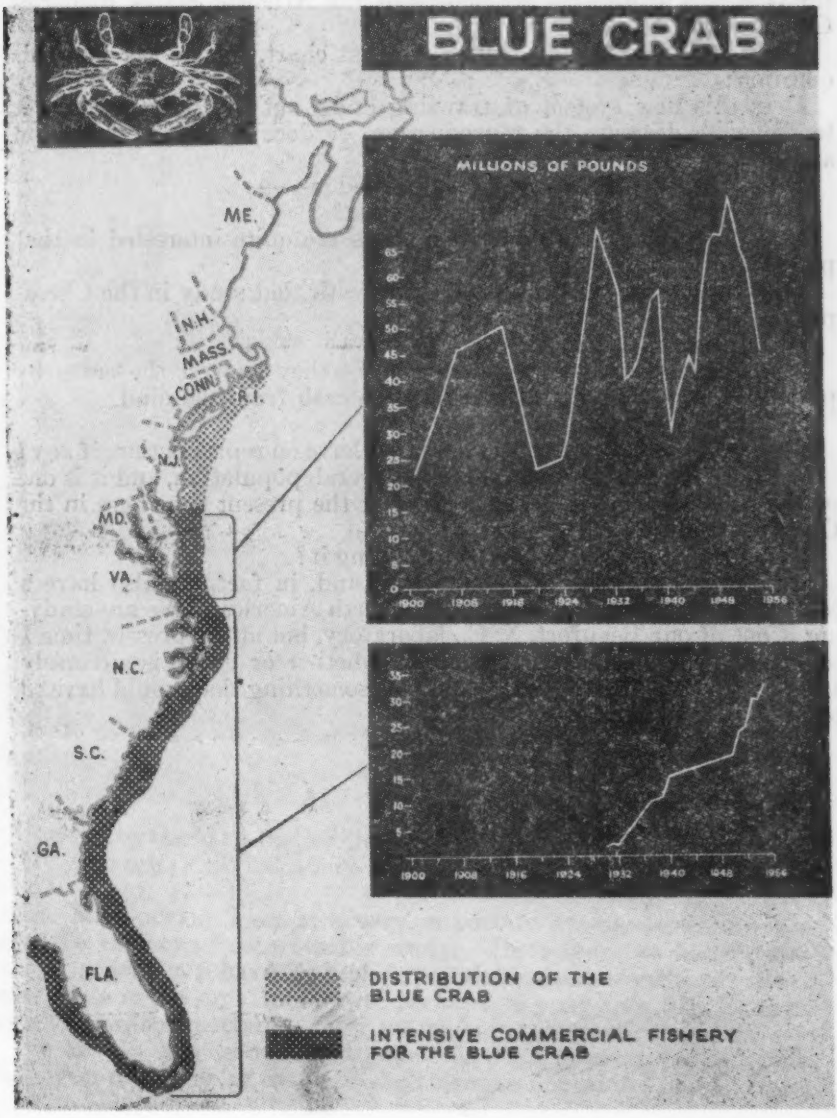
We are proceeding very rapidly with these studies, and hope within a very few years to have this in commercial operation.

In the case of clams, we are almost, in fact, at a point where some commercial growers on the east coast are coming to our laboratory and are studying our methods with the idea of setting up clam hatcheries near their own areas, and we are supplying clams raised artificially in our laboratory to certain commercial growers right at the present time.



Recently we brought some 3 million baby clams down to the Gulf of Mexico in an area where the clam populations were depleted.

In the case of lobsters, as an example of another very important species on the east coast, you can see the very great fluctuation in the lobster production in recent years. The lobsters in the North Atlantic region seem to be increasing in both abundance and production in recent years despite the rather heavy demand for this particular species. This seemed to be related to a change in the environment, a warming of the waters, and a more favorable environment for the young larvae which swim around at the mercy of the waves themselves.



Blue crab is another most important species on the east coast. You can see the rather violent fluctuation in the catch of them. The general production since about 1900 is up, and in recent years the blue crab production in the South Atlantic coast region has gone up. We have an investigation of the blue crab in the Atlantic coast area here, and this investigation is studying the management of this particular species much in the same way Mr. Dingell was asking about a few minutes ago.

It is our idea to see whether there are some areas where the blue crabs are being overfished. We are doing this in close conjunction with the States, and under the auspices of the Atlantic States Fisheries Commission.

The CHAIRMAN. Before you leave that chart, let me ask you this question:

Does this new system of trawling crabs out of the mud have a tendency to decrease the reproduction, or does it affect production at all?

Mr. MCKERNAN. We are quite interested in——

The CHAIRMAN. Do I make myself clear?

Mr. MCKERNAN. Yes, you do, and we are quite interested in that particular development.

The CHAIRMAN. Are you proceeding with that study in the Chesapeake area?

Mr. MCKERNAN. Yes, sir.

The CHAIRMAN. In the winter months they harvest the crabs by putting dredges down and trawling the crab from the mud.

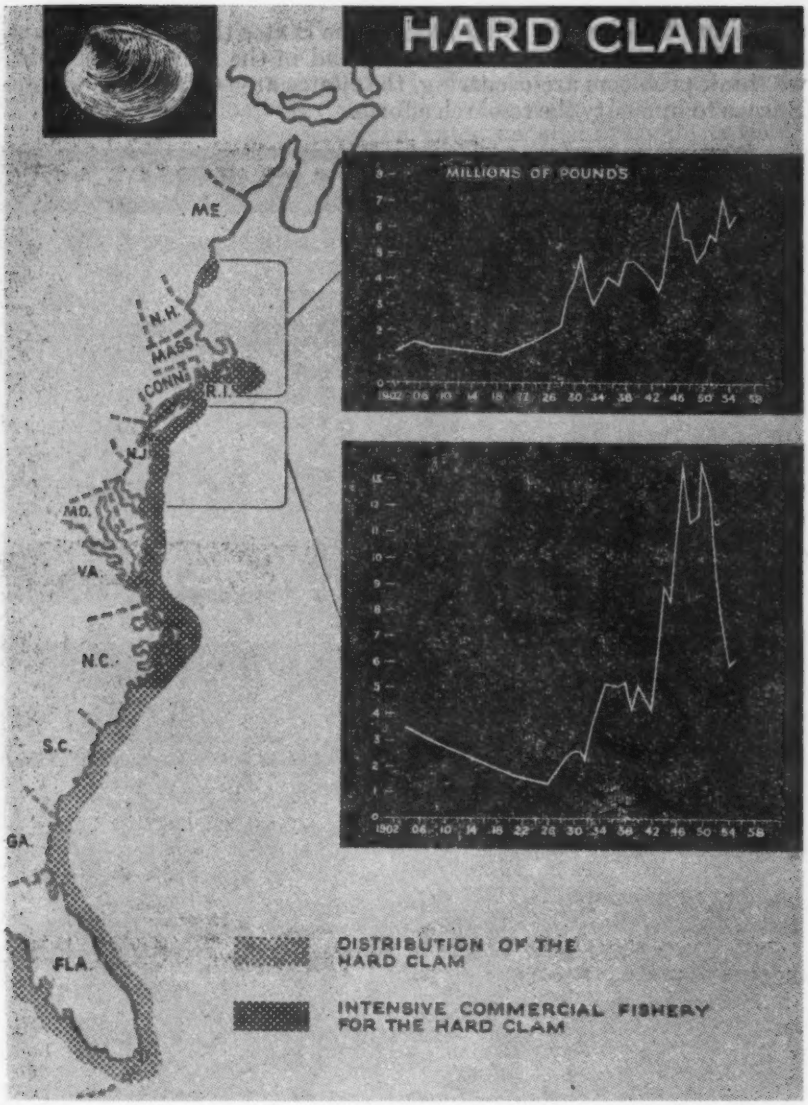
Mr. MCKERNAN. Yes, sir.

The CHAIRMAN. What effect does that have on reproduction, if any?

Mr. MCKERNAN. This could affect the crab population, and it is one of the problems that we are studying at the present time here in the Chesapeake Bay.

The CHAIRMAN. Where are you studying it?

Mr. MCKERNAN. We are studying it and, in fact, we also have a contract with the Oyster Institute of North America. We are studying it out of our Beaufort, N. C., laboratory, but at the present time I could not answer your question as to whether or not it is adversely affecting the crab, but it could, and it is something that would have to be watched very carefully.



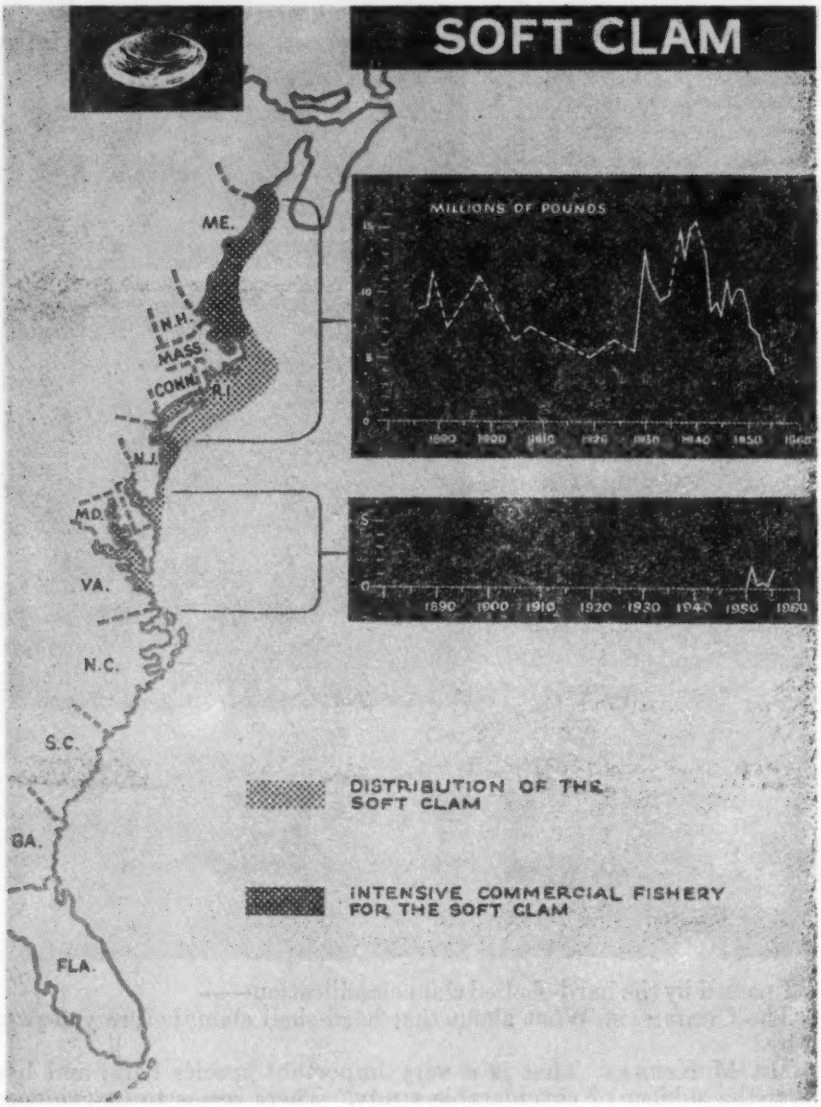
I passed by the hard-shelled clam classification——

The CHAIRMAN. What about that hard-shell clam, before you pass it by?

Mr. MCKERNAN. That is a very important species here, and has been the subject of considerable study. There seems to be evidence that in general the hard-shell clam populations are overfished. Further, there is the surf clam down, perhaps, in your area, Mr. Bonner, which is quite important. I did not include that particular slide.

We have a very good investigation on clam populations to insure that overproduction of the hard-shell clams is not taking place. Here,

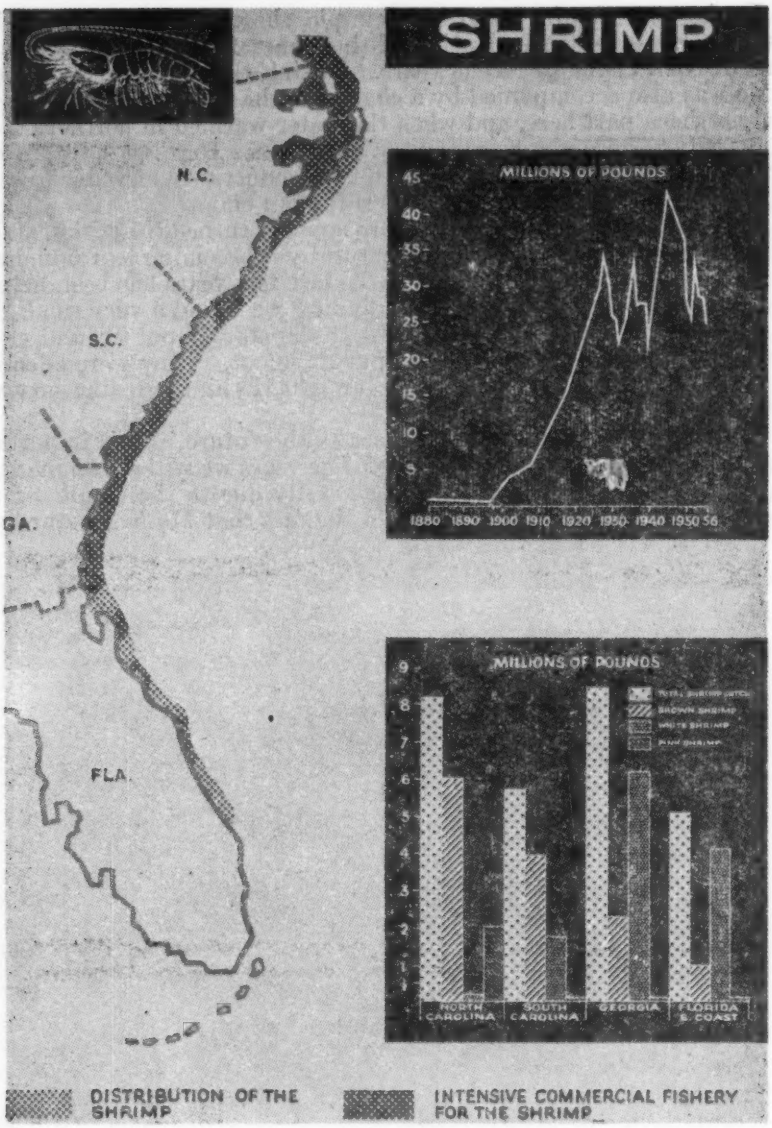
again, our findings are being used by the States through the Atlantic States Marine Fisheries Commission, and in the limited areas where we think problems are occurring, the States are cooperating with the Bureau to intensify the research efforts.



In the case of soft clams, for example, these particular studies led us to an extensive investigation of this general decline that occurred in soft-shell clams in recent years. I think that this particular decline was also accompanied by a change in the water that occurred in the northern part here, and when the water warmed in northern New England, green crabs became very abundant. Here we have an example that because of an increase in the productivity of water toward another species, it has affected the soft-shell clam.

Fortunately for us, Mother Nature now has turned the tables, and it appears as though the green crab naturally is becoming less abundant, the quantity of soft-shell clams in the last few years has been helped by this, and by one other research finding we found a very small, inexpensive fence which is put across the area, and put around clean beds, and a method was found to put these out. They were effective barriers against the crab and also brought, I think, greater survival of soft-shell clams.

So, we are looking with confidence to the future in this important resource, and believe that in the next few years we will see an increase in the soft-shell clam production generally due to the results of research carried out and partly due to the fact that Mother Nature has assisted us in this regard.



We come to shrimp now, and this particular resource is not only important in the Gulf of Mexico, but is also important on the Atlantic coast; in fact, it supplies about 40 percent of the value of all the fishery products on the Atlantic coast, and is by far the most important in the South Atlantic.

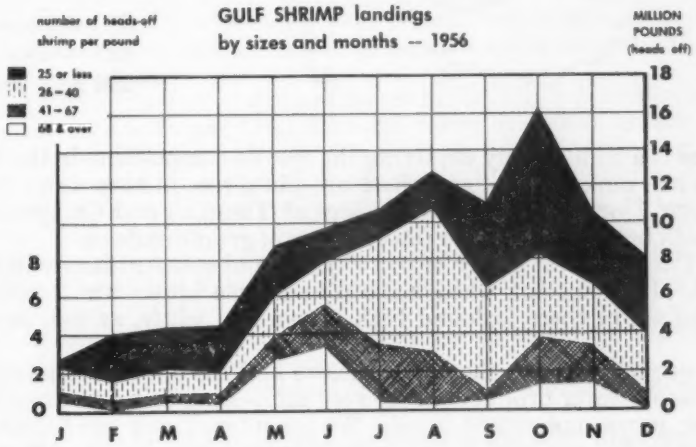
There are three species of shrimp involved, the white shrimp, pink shrimp, and brown shrimp, and most recently our people have found a new shrimp resource in this particular area [indicating], the deep-water shrimp, which has been appropriately named the royal red shrimp. This is a large shrimp, and markets for a very premium

price, and it promises to develop into a very important off-season shrimp fishery. It was found by our research people on the Atlantic coast, and we are now searching to find the limits of these particular beds of this new species which does command such a very fine, high price.

Mr. YOUNG. That is a species of shrimp which is found in the Gulf of Mexico?

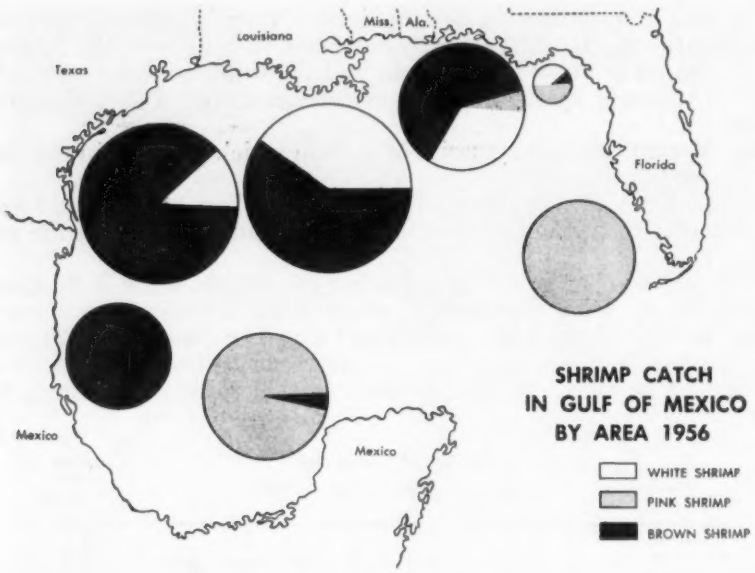
Mr. MCKERNAN. Yes, sir; it is, and we have been carrying out some experiments to try and locate commercial quantities of it in the gulf also.

You can see that general production of shrimp, while it fluctuates rather widely from a period of about 1920, I believe, on through to the present time, it has maintained a rather constant production. An increase in this production probably can be brought about only by finding new beds of shrimp such as this royal red shrimp, and others.



There is one significant thing that our statistical studies have shown us: They show us that in the early spring and summer months the shrimp catch is composed of very small shrimp. These same shrimp a little bit later on in July and August are larger. These are the size where 41 to 67 headless shrimp make a pound, and a little later, in August, we get the greatest production of the larger shrimp, and in October we get the greatest production of jumbo-sized shrimp.

This change in the sizes here is simply a matter of very, very rapid growth in the very rich waters of the gulf and South Atlantic which these shrimp obtain just over one season. It is almost an unheard of rapid increase in growth, and is a greater increase than any other animal of this nature. It shows a general productivity of the Gulf of Mexico in shrimp in inshore areas and inshore waters of the South Atlantic.



Here is a slide simply depicting the species composition in the Gulf. These are pink shrimp, and those are pink, too, in here down in the southern Florida area, and over here at Tampico and Campeche we find both brown shrimp and pink shrimp in great numbers.

In Texas a great many brown shrimp and some white shrimp are found. In Louisiana white shrimp and some brown are found, and in Mississippi there is found both brown and white, as well as some pink.

As we move over on the other side, we find the pink shrimp begin to come into greater production. A very interesting thing occurred here, and we do not understand it yet. We are intensifying our research on shrimp to find out why in the gulf the whites have declined in recent years in this central gulf area, and why brown shrimp have increased. This year there were almost no white shrimp in this area, and this was a surprise; in fact, one of the reasons we heard about it is that the authorities had predicted a good white shrimp year. They predicted this because they felt that the production was controlled by the amount of fresh water and when we had more fresh water, the areas became brackish and that the white shrimp would again increase. We had a good, in fact, 2 or 3 good rainfall years, I believe, in this particular area, and still this year we had an almost complete failure of the young shrimp.

Our scientists are now attempting to study the factors which could have been involved in that particularly drastic decline. This decline hurt the shrimp industry in this area very much, and today some of our important shrimp canneries had to resort to handling other species of fish because there just is not the supply of shrimp to be had.

Here [indicating] is the picture showing the royal red shrimp, and also I must apologize for the slide. It gives you an idea of its general size. They are very succulent and very tender shrimp. This is the

royal red shrimp, the new species we have investigated in both the gulf and the South Atlantic.

Mr. BOYKIN. Where do you find those?

Mr. MCKERNAN. We find them all throughout the northern and eastern gulf, and also in the South Atlantic from about the Carolinas on down to Florida.

In recent years we have developed a new resource from the exploration of fish in the gulf. We found a tuna resource down there, as Mr. Boykin knows, and at the present time there are two canneries in operation. That is an entirely new fishing industry which has developed from these off-shore shrimp resources.

This is not the same species that is found off New England, that is a great big bluefin tuna that gets to be 900 or 1,000 pounds.

This, for the most part is the yellowfin tuna, and it gets to be 50 to 250 pounds, and it is the basis for the great light meat tuna production of southern California. I am not predicting that the Gulf of Mexico will be a serious competitor with the southern California tuna industry; nevertheless, there are several tuna boats now in operation in the Gulf of Mexico utilizing the new resource found through our research efforts.

Now, this slide does not show up so well. What it amounts to is that some of the larger tuna have off colors and they do not make the prime canned product. As one example of our findings in technology, the application of simple ascorbic acid will lighten and make more desirable and produce a better product. This is the same ascorbic acid used in the production of many food products. It is not a contaminant in the sense that it would be objectionable.

Mr. DINGELL. The Food and Drug Administration has no objection to that?

Mr. MCKERNAN. No, they have had no objection to the limited quantities that are required here.

Mr. DINGELL. They do object to excessive amounts of vitamin D added to milk.

Mr. MCKERNAN. Some of the vitamins are actually toxic and some are not.

We have in recent months heard quite a bit about this matter of blood cholesterols. Surprisingly enough, this has come over into our purview and we have studied this particular problem from the standpoint of fish oils.

This slide shows an example of a cross-section of an artery that is choked with lipids, or the cholesterol fats, the hard fats. This is an example of a normal blood vessel. This is an example of one choked with the fat, the deposition within the blood cell.

Many doctors have said this might well be due to the taking into the body of too many of the saturated kinds of fats. These are called stearic fats, and they come from such things as meat, butter, lard, whereas peanuts and soyabeans produce fats that are medium hard fats and have some unsaturated, or double bonds within them.

The arachodonic fats and oils are very abundant in fish oils, and these are the unsaturated fats and the type apparently that do not deposit in the blood vessels. This has been the subject of considerable speculation. I do not think it has been proven that the ingestion

of large amounts of lipids, hard fats, does bring about hardening of the arteries, but nevertheless there are apparently quite a number of medical people that think this contributes and recommend the consumption of greater amounts of fish because fish oils generally contain large amounts of unsaturated or soft fats.

Unsaturated fatty acids in pilchard oils

FATTY ACID	DOUBLE BONDS	% of OIL SAMPLE
C_{16}	1	12
C_{18}	2	18
C_{20}	2 to 3	18
C_{22}	5	14
C_{24}	6	15
	total	*77%*

Here is an example of pilchard oil and it contains 77 percent of the oil of the unsaturated type. They contain from 1 to 6 double bonds within the oils.

We are studying the composition of these oils and also of the fish meal itself and fish protein.

Here is another example of the kind that research has carried on in our technical laboratories. This is in connection with the President's program of atoms for peace. This particular research project is of great interest to the armed services because if, for example, through pasteurization of fisheries products, that is, mild radiation, the bacterial content can be reduced, of course you could actually send greater quantities of any kinds of foods such as farm products as well as fishery products, meat products, overseas without changing them, or freezing them, bringing about a great savings in shipping costs and bringing the products in in a more natural condition to our armed services overseas.

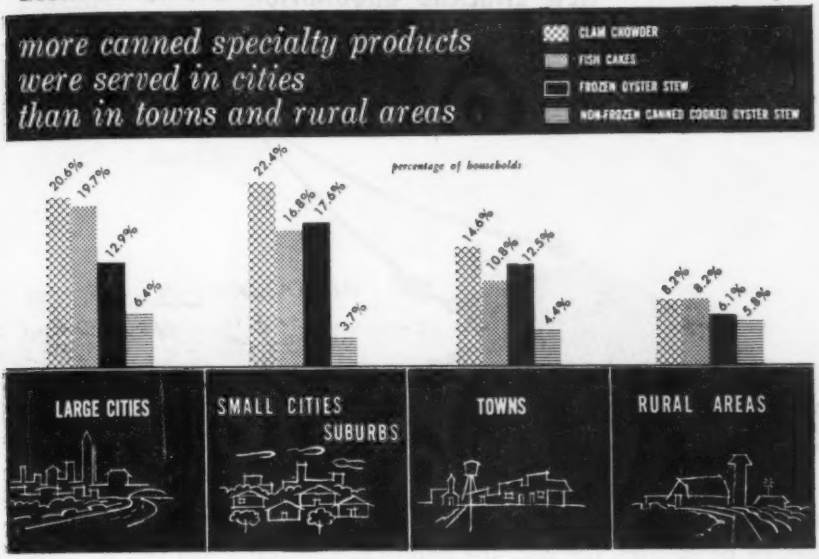
Of course, in time of national emergency it would be of even greater benefit.

By the way, the recent tests that have been made by the armed services show that the success of our project on radiation of fisheries products is perhaps further ahead than for any other food product. There has been considerable success in actually prolonging the life of fisheries products through mild radiation and keeping both the quality as well as the flavor at the optimum range.

This slide simply depicts the fact we are studying the utilization of fish oils. The meals themselves are used extensively in the production of poultry as well as in stock feeds of various kinds.

Through the detection in our laboratories of certain properties of fish oils very recently, they have been used to a greater extent in insecticides. Of course, we have some problems with insecticides also now that are brought about by their great use.

Economic Research Shows Where Promotion Is Necessary



Economic research is another example of the kind of thing that we are attempting to do to promote the welfare of the fishing industry. This slide generally shows at the large cities we use a relatively greater amount of canned products whereas in rural areas we use a relatively greater amount of frozen and nonfrzoen fisheries products.

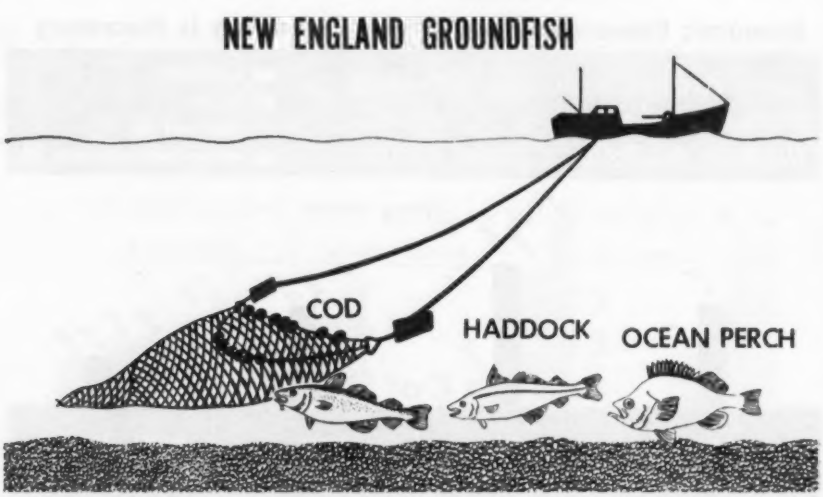
This, of course, is of use to the fish industry because then they can use their limited amount of dollars in promotion and advertising work to a greater extent.

We also provide a service to industry through the fisheries market news service. We act as a clearinghouse for the amount of products. The information comes into 1 of our 7 offices in the morning and the information on both quantity and price is sent, for example, to Chicago the same day. This brings about a better distribution and utilization of gluts of fisheries products of all kinds. When we have a heavy production of haddock in New England or halibut on the west coast, this knowledge is transmitted immediately across the country by a reliable source so both the price and the quantity are known to food brokers.

Mr. GROSS. Is that service something new?

Mr. MCKERNAN. It has been going on since 1937 and it has been implemented just recently to a greater degree. The market news reports come to the producers, to the canner, and to the retailer.

Now, I am coming to one of the special subjects that I thought I would review in slightly more detail with you and give you an idea of the kind of detail that is going on in economic and biological research, and give you an idea of some of the most critical problems facing our commercial fisheries.



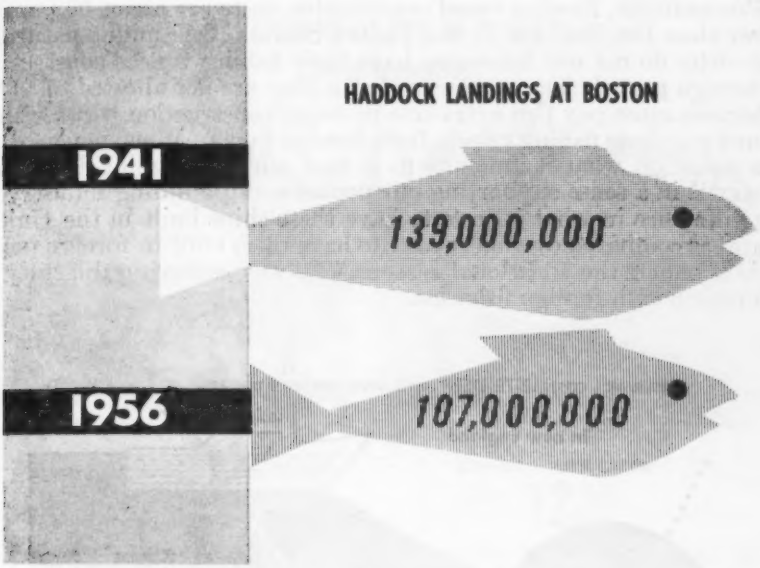
This is an example of the New England ground fish boat, a trawler. This shows the kind of net he uses. This also shows the principal species he catches, the cod, the haddock, and the ocean perch. These species are filleted and sold on the fresh-fish market and frozen. Some are put in blocks and are cut up and put out as fish sticks.

The New England fisheries bring in cod. Our cod stocks are another species of fish that have declined to a drastic degree in recent years. Our biologists speculate as to whether all of that is caused by overfishing, or some of it is caused by changes in environment. We believe overharvesting has been part of the problem in the cod decline but perhaps not the whole problem. Haddock has been maintained at a relatively constant production in our own Georges Bank, and you can see this rather constant production of haddock. I will comment on that more in a minute.

Redfish declined rather drastically until about 1953. It has been maintained at about a constant level ever since. The utilization of pollock has been relatively greater in recent years. This indicates that the production is rather stable of these species.

Just very quickly going to other major species in New England, herring appear to be maintaining themselves rather well. This year there was a bumper crop of herring and our people in Main had herring coming out of their ears. The sea scallop fishery is one in danger of overharvesting, because of the very high market price. That has brought about an increase in fishing, and while it is maintaining itself at its persent level, we are carrying on research to ascertain at what level of population size the maximum sustainable yield can be reached.

This slide shows an actual picture of the *Delaware*, one of our own research boats in New England. But it is a typical example of the large type of ground fish vessel that this fishery calls for. They are large vessels, up to 150 feet in length. They were boats requiring all kinds of deck space and a rather large crew, up to 15 or 16 people. The investment in the boats is well up to $500,000 each. They are not an inexpensive boat.



Now, taking Boston as an example, in 1941 there were 139 million pounds of haddock brought into the landings. In 1956, 107 million pounds. Our statisticians tell us that this year the catch of haddock in Boston has declined to 97 million pounds. This has been so in the face of an increasing population of haddock available to our fisheries. This slide unfortunately is not too good for our purposes here, but this is an example, a diagrammatic sketch, of the Boston fish pier. It shows that in 1941 there were 3,276 trips landed. In 1956 there were only 912 landings at the Boston fish pier. This is because of the decline in production.

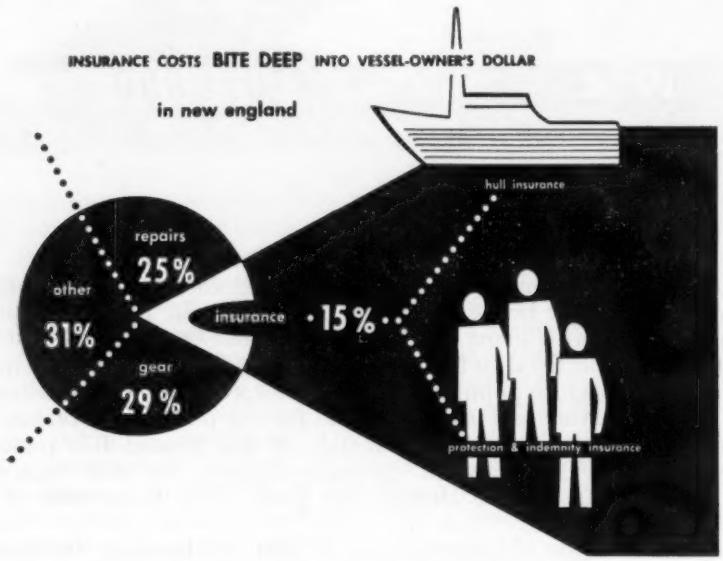
Why have we lost this production of fillet fish landings in Boston? Well, this is the general situation since 1948. The production was relatively constant then, but at the time when imports began increasing so drastically the domestic production began going down. What it amounted to was our fishermen simply could not compete with the increasing imports from Iceland, Canada, West Germany, and Norway.

In 1939, as an example, the United States production was about 100 million pounds and imports were only about 10 million pounds. We had a flourishing fishery and we did not have the economic problems then. I will have to describe this in some detail.

This is our Georges Bank. One of the problems we have is that we have to go some distance to catch our fish. We have Georges Bank, which is close to Boston, within about 75 miles, but we have a several-hundred-mile trip to both the Grand Banks and the St. Lawrence Gulf and other fishing areas. With the increased cost of oil and all kinds of gear for our fishermen, the increased costs of supplies themselves for long trips, our fishermen have been more hard put to compete successfully with these imports.

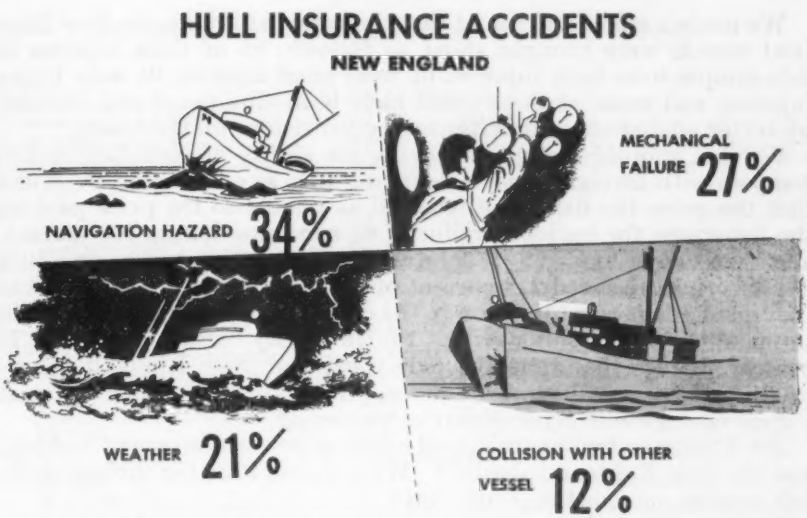
Vessel construction is another interesting item and shows the costs, the differential costs that our fishermen are faced with.

For example, foreign vessel construction costs are about 30 percent lower than the costs are in the United States. One might naturally ask—why do not our fishermen have their fishing vessels constructed in foreign ports? The answer to that is they are not allowed to. Our fishermen must pay this extra cost in vessel construction because they cannot purchase fishing vessels from foreign ports. When you analyze this situation what it amounts to is that our commercial fishing industry is in a sense supporting our domestic shipbuilding industry by the difference in what it costs to have these ships built in the United States as compared to what it costs to have them built in foreign ports. This is one of the additional reasons why we are having difficulty in competing with foreign fisheries.



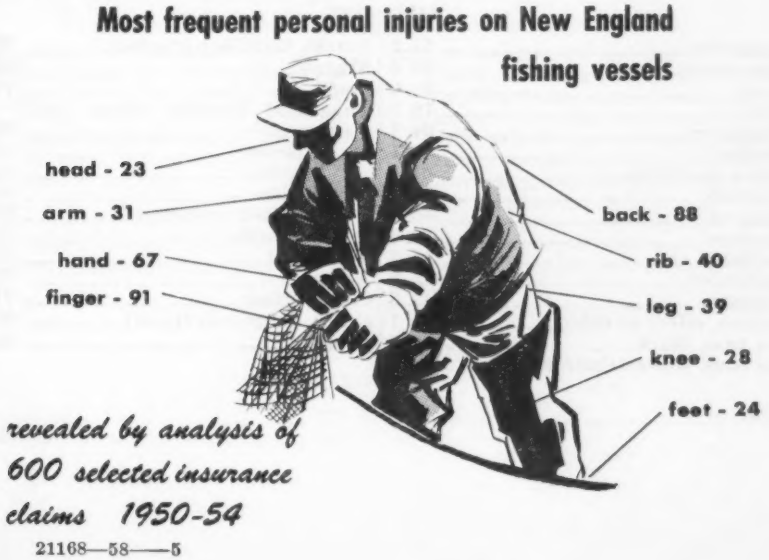
Another example, I may say, of increased costs and difficulties that our fishermen are having are the insurance costs which are rising perceptibly, in New England expecially.

Insurance costs in foreign countries that are competing with our people are partly borne by the Government. Another factor in these rising costs is the fact that our fishermen in New England are almost on their knees. They have lost the capital to be able to replace their worn keels and keep their fishing vessels at topflight performance. This, of course, brings about increased accidents on the boats, both to personnel as well as accidents to the hull because of a lack of being able to keep navigation equipment repaired properly, and so forth.



Here is an example of the study that we are carrying on. I am sorry this does not show up better. This is a study to show where accidents occurred on the vessels. It shows that the hull accidents—that is, 34 percent of all accidents to fishing vessels—were brought about by hull accidents and 25 percent were brought about by engine failure, 21 percent by storms, and 12 percent by collisions.

Let us just analyze this for a moment. We can see if our industry was able to keep these boats in top form, keep the machinery up and replace wornout machinery, we could substantially reduce these top two items, which would amount to about 61 percent of the accidents. That is, with better navigation equipment, and also better engines, and a lack of engine failure and equipment failure, our vessels then could produce fish cheaper and could keep insurance costs down and could compete more favorably.


Most frequent personal injuries on New England fishing vessels
head - 23
arm - 31
hand - 67
finger - 91
back - 88
rib - 40
leg - 39
knee - 28
foot - 24
revealed by analysis of 600 selected insurance claims 1950-54

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We made a study and found that the personal injuries to New England vessels were brought about as follows: 88 of these injuries in this sample were back injuries, 67 were hand injuries, 91 were finger injuries, and some of these could have been eliminated and lessened by better equipment and better safety provisions on the boats.

We find another factor influencing the ability of New England to compete with foreign imports. Taking 1942 as a base year, we found that the price the fishermen received as related to the price paid by the fishermen for various products, we can take that as 100 percent, and then take a look at 1955, and we find in relation to the year 1942 the fishermen received 114 percent of the 1942 price for their fish but they paid 164 percent increase in the cost of all products that went in to make up these fishing trips. So the parity ratio to 1955 was 70 percent. Since that time the parity ratio of New England fishery products has gone down even more, putting our fishermen again at a disadvantage with other countries importing.

Mr. DINGELL. Is that true in all cases, or just in the case of haddock and the New England fisheries? What would it be for shrimp, rockfish, oysters, or something like that?

1955 New England area parity ratios under 100 (annual average)

[1942=100]

Alewives	64.1	Pollock	40.0
Butterfish	78.1	Scup	60.6
Cod	67.5	Sea bass	45.8
Cusk	60.9	Sea herring	69.6
Eels	55.6	Skate	57.9
Greysole	95.5	Swordfish	70.9
Haddock	61.0	Tuna (horse mackerel)	40.8
Hake	45.7	Whiting	28.3
Halibut	83.8	Wolf fish	94.9
Menhaden	68.8	Mussels (sea)	69.2
Ocean perch	80.0	Scallops (sea)	99.8
Ocean pout	25.2	Squid	73.6

1955 Pacific coast parity ratios under 100 (annual average)

[1942=100]

Anchovies	53.2	Sharks, including greyfish	76.4
Barracuda	94.9	Skates	68.9
Carp	71.0	Smelt	77.1
Cod	78.7	Tuna and tunalike fishes, total (average)	78.2
Flounders	64.1	Albacore	49.2
Halibut	58.1	Bluefin	92.9
Horse mackerel	61.2	Bonito	49.2
Kingfish	54.7	Skipjack and striped	91.6
Lingcod	45.0	Yellowfin	97.2
Mackerel	73.6	Yellowtail	65.8
Ratfish	45.7	Abalone	75.4
Rockfishes	45.2	Clams, razor	71.1
Sablefish	49.8	Crabs, dungeness (hard)	96.9
Salmon, silver or coho	95.1	Squid	28.0
Sea bass, black	69.7		
Sea bass, white (California)	98.2		

1955 gulf coast area parity ratios under 100 (annual average)

[1945=100]

Bluefish	45.4
Bluerunner or hardtail	49.2
Buffalofish	43.9
Catfish and bullheads	50.9
Croaker	10.6
Drum:	
Black	52.9
Red or redfish	62.4
Flounders	49.0
Groupers	51.3
Kingfish or king mackerel	41.6
King whiting or kingfish	26.8
Mullet	39.2
Sea catfish	47.6
Sea trout:	
Spotted	69.6
White	14.3
Sharks	87.1
Sheepshead:	
Fresh-water	87.9
Salt-water	70.2
Snapper:	
Mangrove	85.6
Red	73.2
Spanish mackerel	48.9
Spot	33.6
Tenpounder	44.5
Crabs:	
Hard	59.0
Soft and peelers	41.8
Stone	61.3
Spiny lobster	69.6
Clams, hard, public	60.4
Oysters, market:	
Public, spring	54.3
Public, fall	36.4
Private, spring	43.3
Private, fall	44.7
Sponges:	
Grass	50.8
Sheepswool	35.2
Wire	42.2
Yellow	28.0

1955 parity ratios over 100 (annual average)

PACIFIC COAST

[1942=100]

Groupers	105.6
Herring, sea	104.4
Pilchard	115.9
Salmon: average all species	100.5
Blueback, red or sockeye	107.5
Chinook or king	119.6
Chum or keta	130.2
Humpback or pink	174.8
Shad	128.3
Steelhead trout	103.6
Swordfish	119.7
Clams: average all species	105.4
Hard	148.1
Lobsters, spiny	122.3
Oysters: average	118.6
Pacific, market	129.6
Western, market	166.4
Shrimp	177.3

NEW ENGLAND

[1942=100]

Flounders:	
Blackback	113.6
Dab	129.6
Fluke	108.5
Lemon sole	103.0
Yellowtail	140.4
Mackerel	125.4
Shad	161.5
Smelt	220.1
Rock crabs	140.9
Lobsters	103.2
Clams: average all species	165.1
Hard, public	116.0
Hard, private	251.5
Razor	264.8
Soft, public	206.8
Oysters: average	184.3
Market, public spring	214.9
Market, public, fall	183.6
Market, private, spring	188.1
Market, private, fall	192.5
Scallops, bay	103.5
Bloodworms	214.1
Sandworms	124.2

GULF COAST AREA

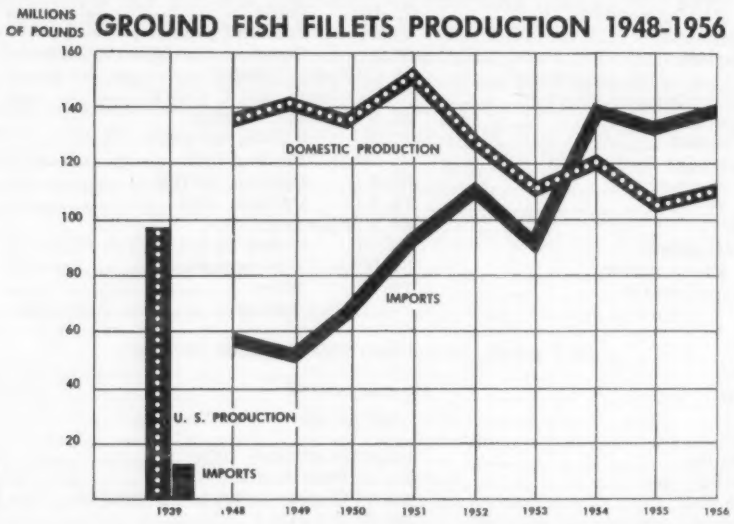
[1945=100]

Menhaden	129.3
Pompano	100.5
Shrimp	130.2

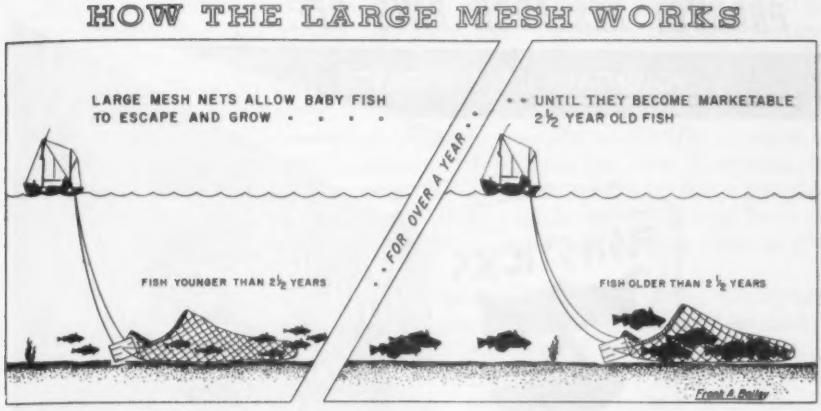
Mr. McKernan. Those particular figures have not been computed for all fisheries, but they have been for tuna. I intended to show those for tuna. I do not believe that has been computed to date for all fisheries.

Mr. Dingell. Would it be fair to say in some cases the parity ratio is up?

Mr. McKernan. I would expect that would be the case. Mr. Anderson says it would be true in 1 or 2 instances.



I am using this particular slide because about 1948 the New England industry found itself in an economic stress and they came to the Government and requested some Tariff Commission help. They were turned down. They came back in about 1951 or 1952 and asked again and it was found at this time there was harm being done to our domestic fisheries from imports. But the President turned down this request for increased tariffs because he saw that there was a new development in the fish industry and that development was a new industry in fish sticks. It was booming in the early 1950's and he thought this would cure the ills of the New England fishing industry, and so did we in the Bureau, but it did not because it turned out that the imported fish blocks could be produced so much more cheaply than our own fish blocks that 95 percent of all the fish sticks now purchased in the United States are produced from imported fish. We have done quite a bit of thinking about this particular problem. We have not stayed stationary and the Government has attempted to the very maximum to assist in every way possible.


HOW THE LARGE MESH WORKS
LARGE MESH NETS ALLOW BABY FISH TO ESCAPE AND GROW
FISH YOUNGER THAN 2½ YEARS
FOR OVER A YEAR
UNTIL THEY BECOME MARKETABLE 2½ YEAR OLD FISH
FISH OLDER THAN 2½ YEARS
Frank A. Bailey

This is the research vessel, the *Albatross III* that is headquartered at Woods Hole. This *Albatross III* has carried on studies of net mesh regulations in conjunction with the North Atlantic Treaty. We have implemented these regulations on the haddock fisheries and have found by increasing the mesh size to 4½ inches we allow the fish to become some 2½ years older, approximately 4 times as large and the catch itself is increasing. In fact, the populations are increasing in size and this is bringing about an increase in the general population level of New England haddock.

Mr. BOYKIN. I must leave, but I would like to say that I think this is the best statement I have ever heard and I have been on the committee for over 20 years. It has been wonderful. I certainly appreciate what you have told us.

Mr. MCKERNAN. These particular research results have now been implemented by the North Atlantic Treaty and the various countries involved, including France, Portugal, Canada, and other countries are implementing the net studies which have been carried out in a cooperative manner by the Federal research departments of these various countries.

Here is an example of the technological assistance that we have put it. In 1940 we had no technologists in New England giving the industry any help. In 1950 we had a rather small establishment in east Boston to carry out technological studies and attempted to help in the improvement of quality and of the marketing distribution of fish. Now, in 1958 we have a new laboratory being constructed at Gloucester, one of the hardest hit ports in New England, and we hope again this will contribute to the betterment of the New England fisheries.

One of the technological findings that have been implemented by the industry is the matter of bone detection in fillets. One of the problems we have in competing with a country like Iceland or Norway is the very strict governmental controls to provide a very high quality product. The housewife demands it and deserves it. This is one of the findings of our technologists which has been implemented and shows the bones that were improperly cut out during the filleting process.

We are also working with the industry very closely in the development of grade standards, that is, quality standards, and when the customer finds this particular stamp on fishery products, on fillets and fish sticks, he can be assured that rigid standards of quality were observed in the manufacture of those particular products.

Mr. GROSS. Does that apply to the foreign imports?

Mr. MCKERNAN. No. Some of the foreign imports, Mr. Gross, are examined in their countries. Some of them may have even a stamp showing inspection, but this particular stamp occurs only on domestically packed fish.

Mr. GROSS. I would rather rely on American inspection than upon foreign inspection, would you?

Mr. MCKERNAN. Yes. You will notice this big No. 5 indicates we have either in effect or in active development the standards for five commercial fisheries products. Among them are raw-breaded shrimp, for example. Also, fish sticks. Also fish blocks and other such important species that are sold in the frozen state.

This gives an example of exploratory fishing work we have carried on in New England. We have found other resources that are now being utilized. We found new beds of sea scallops that are being used by the industry. We found tuna resources off here that show promise of being utilized. We are also finding stocks of bottom fish which can be utilized by our trawl fisheries in the deep waters off of the New England coast, and promise to help to some extent this industry which is in bad condition.

We have developed a small telemeter that we have put on a trawl so when the vessel locates schools of fish with fathometers and other fish-detecting devices, they can then locate them and lower their net at precisely the right level and take advantage of this.

Other foreign countries and other foreign fishing fleets are working toward these ends too. This happens to be our own development and is one way we are actively attempting to make our fleet more competitive to bring in fish cheaper.

When we were here almost 3 years ago we mentioned the development of freezing fish at sea and how this was a necessary development to get a high quality product to the American housewife's table. This development has proceeded and the most recent action in this regard has been the formulation of a committee of New England industry people that are working with our people, and with an outside contractor, an outside naval architectural firm in New England, to study the costs of such a freezing vessel which would go out a greater distance, stay a greater length of time, and bring in a full load of frozen fish every time despite the vicissitudes of fishing that might occur from one trip to another.

This is a very promising development. It is one that the European competitors of ours are using to a great extent. In West Germany, for example, they have a very large number of modern trawlers at the present time, and other countries are actively engaged in this regard.

We have assisted the industry in the development of promotional material for fishing parades. Our people in the field have simply worked with the industry to attempt to develop programs which will accomplish a better distribution and a better sale of commercial fish products.

The boat loan fund, which I am sure most of you have heard about, came into effect with the fisheries law of 1956. A $10 million boat loan fund is summarized at page 63 of the booklet you have and it indicates we have applications for some $13 million worth of loans. We have actually approved, or the Assistant Secretary has, some $4 million worth of loans, I believe, and there are pending considerably more loans.

In the case of the tuna industry some of the people want us to hold up giving them their loans because their own financial position is such they felt they could not accept the loan and repay it at the present time.

Mr. DINGELL. Are you using by any chance the practice that Small Business uses by asking the recipients of these loans to seek bank participation?

Mr. MCKERNAN. We are providing for loans only where the banks will not loan.

Mr. DINGELL. You do not ask them to obtain bank participation?

Mr. MCKERNAN. No; we do not ask for bank participation. What we are required by the act to ask for is evidence from the banks that these particular loans are beyond their ability or it is beyond their own purview to make the loans.

Mr. DINGELL. I would not be critical of such a practice. In fact, it would make that money go a whole lot further if done wisely, and it would get to more people if you followed that policy.

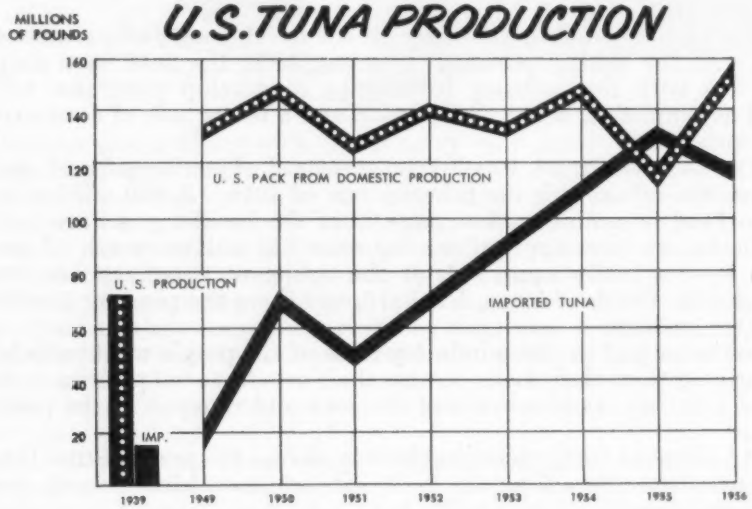
Mr. MCKERNAN. But these loans have been applied in areas of a critical nature. For example, the preponderance of these loans have been approved for both New England and a good share for southern California, and our Pacific Northwest salmon people as well as the gulf shrimp and menhaden people.

This is the place where I would like to talk about the tuna problem in some detail, Mr. Chairman. Would you like me to proceed?

The CHAIRMAN. Yes.

Mr. McKernan. This [indicating] shows the general extent of yellowfin and skipjack fishing which goes on on the west coast of the United States. Our fisheries started off Lower California, and it has now extended to Central America and down the coast to Ecuador and Peru.

Most of the fishing itself is done offshore anywhere from 10 to 100 miles. A very recent development in tuna fishing goes on around the Galapagos Islands. We discussed a while ago whether or not the fleet had overfished the tuna fishing grounds. A general answer to that is that in the inshore waters they have exploited the yellowfin but they have not exploited the great skipjack resources which we know are concentrated farther offshore. It appears that maybe our fisheries are utilizing the yellowfin almost to its maximum capability, and the skipjack nowhere near its maximum capability.

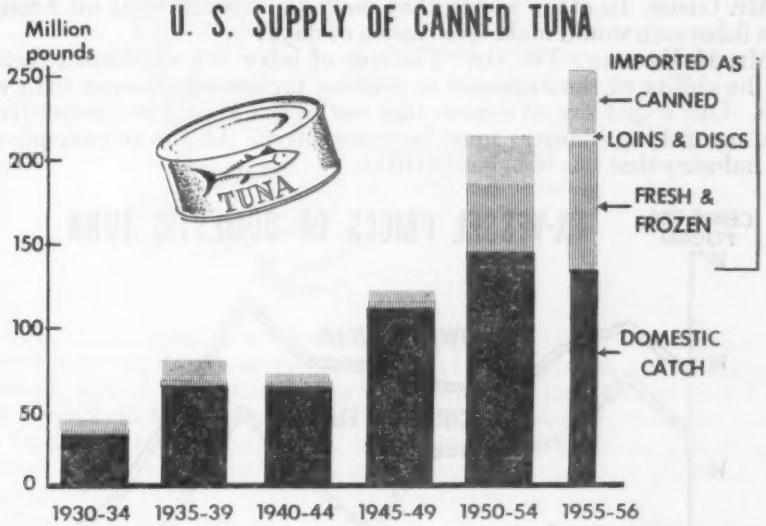


Here, again, we have somewhat the same picture in New England. Our own tuna fisheries increased during the war, and after the war, and as soon as the importation, primarily from Japan, began to increase, our own production has leveled off, and vessels have been leaving our fleet and practically no new vessels have been constructed. The competition from Japan has become much more acute.

Here [indicating] is a typical tuna vessel, and on these particular live bait boats the live bait well is back here [indicating] and they feed out small herring, anchovies and chum, and throw them out over the back end of this boat. These vessels are worth anywhere from a quarter of a million dollars to three-quarters of a million dollars and are a sizable investment in capital. They have thrown very young live bait over the back of the boat, and here [indicating] these fishermen put a feather on a line and a hook in the water, and the tuna come up behind the boat after the bait, and bite these particular hooks, and

the moment they bite these unbarbed hooks, the fish are tossed on the deck, and the hook comes out of their mouth automatically. They can harvest tons of these fish in a few hours' fishing time when the tuna will stay behind the boat, and when fishing is done. This [indicating] is an example of the kind of tuna.

This is the yellowfin tuna, and you can see the yellowish cast on the small fins. That is about a 50-pound tuna.



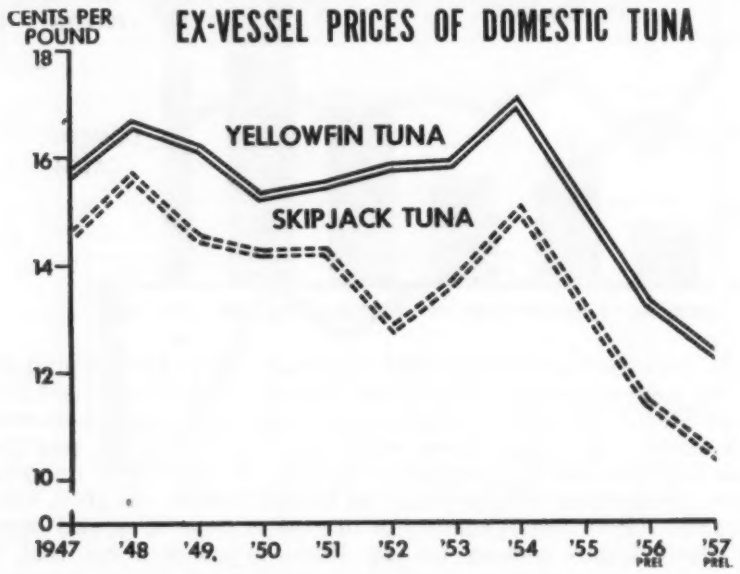
This shows rather dramatically what happened: In 1933 and 1934 our own domestic catch was the predominant factor in tuna used in the United States. In 1935 to 1939 during all of these years there was a small amount of canned tuna which came in before the war from Japan and from South American countries. It was not an important feature in the tuna utilization in the United States. In 1950, frozen tuna from Japan began coming in in greater quantities, and canned tuna itself began coming in. In 1950–54 you will see that the domestic catch is over one-half the total United States supply of canned tuna. The remainder is imported fresh and frozen and canned. In 1956 the new development of loins and discs began to come in. They are simply the fish loins all ready to box up and put in the cans. The discs themselves are perfectly round, can-size pieces of tuna, and all you have to do is put them in a can and put them in a sealer and that is all there is to it. This is a significant development, and it means that the Japanese are attempting to take over another part of the tuna industry, that part which deals with the labor involved in cleaning the fish itself, you see, and preparing the loins for processing.

Mr. GROSS. Do you have any information on the hourly pay of a Japanese fisherman?

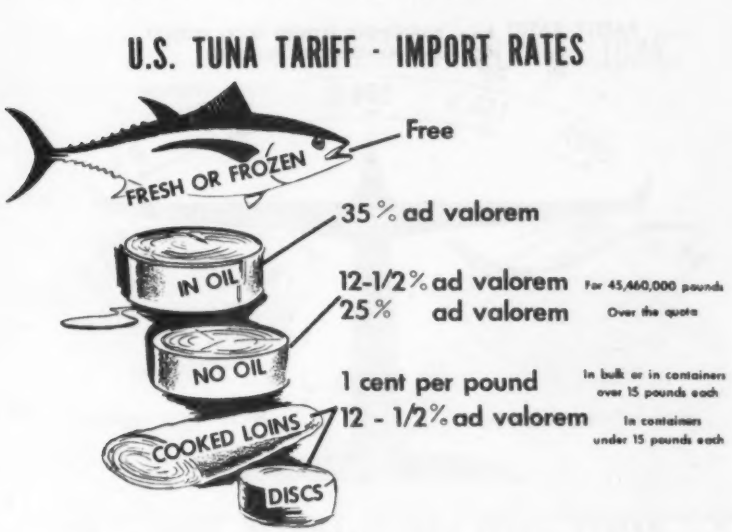
Mr. McKernan. Yes; I know something about that, Mr. Gross. A Japanese fisherman is a highly paid employee of the Japanese economy, and the tuna fisherman makes, roughly, $30 a month. This is an approximate figure, and I hope you will forgive me if I am off a little bit in that, but that was the figure when I was over there in about 1950. It may be a little higher, but not significantly; $30 a month as compared, of course, with the needs of our own fishermen of, I suppose, perhaps $5,000 a year, or something like that, is the figure.

Mr. Gross. In other words, they make in a month what an American fisherman would make in a couple of days?

Mr. McKernan. Yes, sir. The cost of labor is a significant factor in the ability of the Japanese to produce tuna much cheaper than we can. One might say, of course, that our people should be competitive, and our fishing industry must be competitive. This is an example of an industry that has been competitive.



The tuna people have constantly cut prices, and this is an example of our ex-vessel price of domestic tuna from 1947 on through to 1957. You can see that yellowfin tuna, for example, the ex-vessel price in cents per pound has declined rather steadily, and is now considerably less. This is one food also, for example, that has actually declined in price in recent years, instead of increasing.

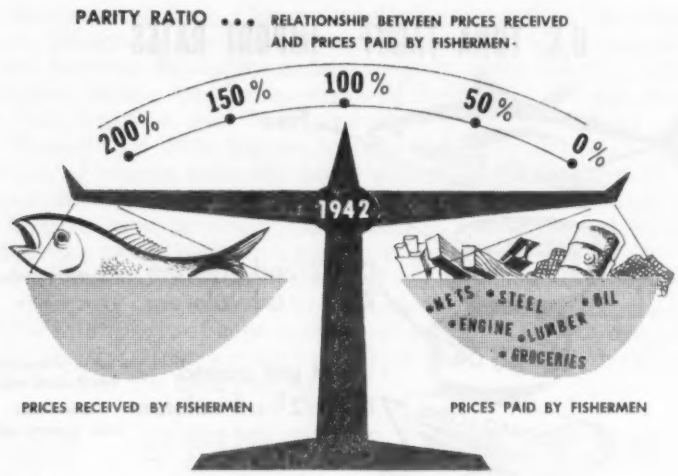


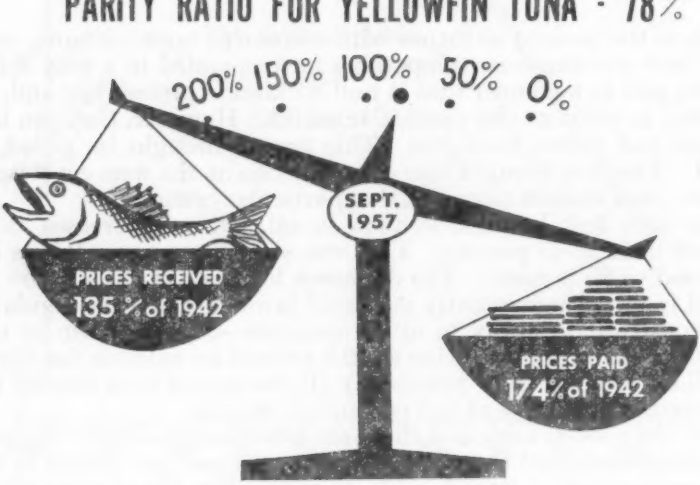
This is the general situation with respect to tariff on tuna, and it shows how our Japanese competitors have operated in a very skillful manner, and in a manner that is well within the present law and, I do not mean to criticize this particular action. However, they can bring in fresh and frozen tuna free. This tuna is brought in, gilled, and gutted. They are brought into our canneries on the west coast and on the east coast, and are canned at that particular cannery.

They also first brought in tuna in oil, but we increased the ad valorem tariff to 45 percent. That was some years ago. It was later decreased to 35 percent. The Japanese bring in practically no tuna canned in oil. Inadvertently our tariff laws—because the regulations were construed to apply to other countries—allowed them to bring their tuna canned in salt brine at 12.5 percent ad valorem for the first 45 million pounds. Now practically all the canned tuna coming from Japan comes in in brine at 12.5 percent ad valorem.

Now, the cooked loins and discs are also inexpensive by our particular tariff laws, and they bring these in at 1 cent per pound in bulk, or in packages of 15 pounds each, or in the disc, the can-size bit, you might say, at the same general cost. So that now what seems to be developing is that the Japanese first went from the higher tariff item of tuna in oil down to the lower tariff item of canned tuna in brine. They are competing now with frozen tuna which is free, but for which they actually provided the labor in Japan.

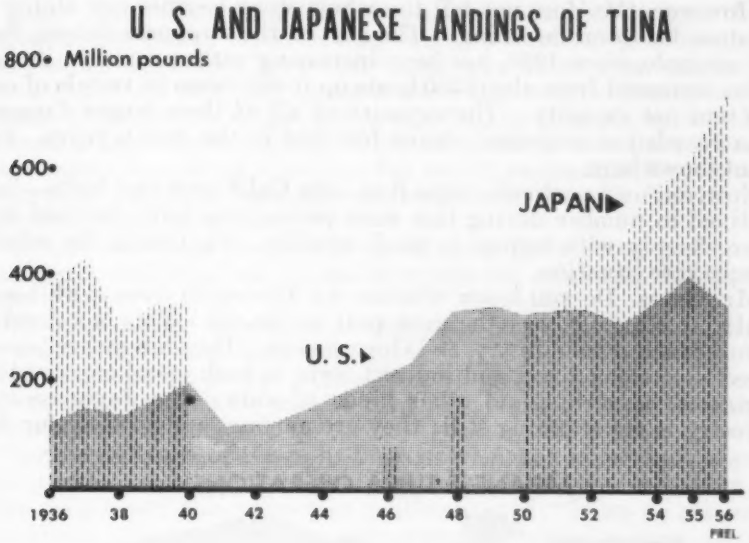
And they bring in the loins and discs in their raw state.





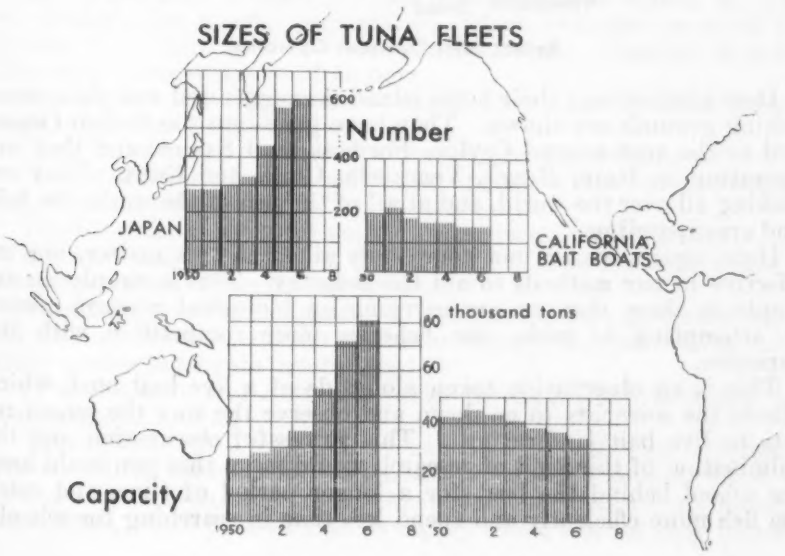
Here [indicating] is the parity ratio that was asked me a while ago for yellowfin tuna, and this showes the parity ratio for yellowfin tuna based on 1942 was 78 percent in September 1957. That is the price paid with respect to the price paid for the necessary elements that go in to make up a fishing trip which puts the fisherman into a very poor competitive condition, and which is one of the causes for his difficulties.

However, since 1952 while wholesale prices of all commodities increased 8 percent, the wholesale price of canned tuna—and this is a relatively vital product—decreased 11 percent. Therefore, in fact, canned tuna with respect to its former price on the store shelf is a very good buy today.



This [indicating] is another little closer look at this competitive situation with Japan. You will see that the Japanese production, of course, was cut off, and the Japanese landings of tuna, not plus our own landings, were in the neighborhood of 350 million pounds up until 1940 and then, of course, during the war years they were practically nil.

In 1950 the Japanese tuna production began at about 300 million pounds, and in 1955 they got up close to 800 million pounds. Our own fisheries were increasing rather sharply until about 1949, and from then on our own production has been constant.

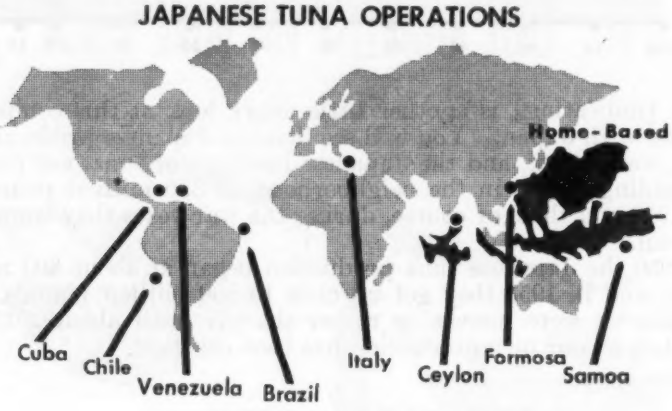


However, this does not tell the whole story because our ability to produce has been declining. The size of the Japanese fishing fleet, for example, since 1950, has been increasing rather rapidly; in fact, it has increased from about 300 boats up to 600 boats in vessels of over 100 tons net capacity. The capacity of all of these larger Japanese tuna vessels has increased almost fourfold in the past 6 years. 1957 is not shown here.

Now, our own particular tuna fleet—the California bait boats—have declined in number during this same period, and have declined even more sharply with respect to total capacity. So, that is the relative competitive situation.

Mr. GROSS. Do you know whether we also equip them with boats?

Mr. MCKERNAN. For the most part we do not. This is a development of their own industry, and Government. They are rather heavily aided in various direct and indirect ways in both vessel construction, insurance payments, and other kinds of aids. The Japanese tuna industry is not standing still; they are moving, and looking for fish.



Here [indicating] their home island is exaggerated and their home fishing grounds are shown. They have gone into the Indian Ocean, and to the area around Ceylon, Formosa, and Samoa, and they are operating in Italy, Brazil, Venezuela, Chile, and Cuba. They are looking all over the world, and at all of the fish of the world for fish, and are expanding.

Here, again, we are not completely silent in this matter, nor ineffective in our methods to aid the industry. This is simply an example to show that we are carrying on biological research aimed at attempting to make our fisheries more competitive with the Japanese.

This is an observation taken alongside of a live bait boat, which allows the scientists to go down and observe the way the school reacts to live bait [indicating]. This successful observation and the culmination of this kind of research would mean that you could keep the school behind the boat for a longer period of time, and catch the fish more efficiently and spend less time in searching for schools.

It could show what would be the proper amount of bait to throw overboard, because now, of course, this is a wasteful practice in the sense when you empty your bait tanks, you have to go ashore and take all the time necessary to catch more bait, and then come back.

Here [indicating] we go out to the fishing grounds again. It is estimated that approximately from one-half to two-thirds of our time is spent in seeking schools of fish and if we can aid them through research in catching these fish more efficiently, it will directly help them in a competitive sense.

We can also help them in a special tuna promotion, and special tuna week, and help market and promote the sales and distribution of their fish.

We have carried on economic studies to find out who eats tuna so we could concentrate their sales promotion on the American public. We found that the young adults from 15 to 39 were the people who ate the most tuna. Our middle-aged group ate less, and the elderly group ate only 13 percent.

This reminds me of the quip I heard when the same study showed that in the case of salmon the highest consumers of salmon were the older people, and this particular gentlemen said: "If we do not watch out, pretty soon, and get new customers for canned salmon, we will have to dig up the old ones."

We are operating under the Fisheries Cooperative Marketing Act, and we not only provide information and assist in the formation of fishery cooperatives, but it is our duty also to police these cooperatives. One of the best examples is the big tuna cooperatives in southern California.

Now, this particular subject [indicating] is Alaska, Mr. Chairman, and I would be pleased to go right on with this subject or carry on as you like.

The CHAIRMAN. Well, it is now a quarter of 1 o'clock. How much more time would you need?

Mr. MCKERNAN. I can limit my presentation or extend it. If I go through the Alaska presentation, which indicates some of our problems up there and the Great Lakes lamprey situation, it would take about three-quarters of an hour.

Mr. ALLEN. Mr. Chairman, we might have more members present some other time than we do now.

The CHAIRMAN. I wonder if we could meet this afternoon?

Mr. MCKERNAN. I am scheduled to appear before you on Monday, but of course I do not know.

The CHAIRMAN. I expect we had better recess until Monday.

It has certainly been most interesting. I have been interested in the presentation of this fishing problem.

Now, before you wind up, are you going to put into the record where all your studies are, and the amount of money that has been spent on these studies in private institutions?

(For Research and Activities under the Saltonstall-Kennedy Act, see appendix, p. 281.)

Mr. MCKERNAN. Yes, sir, Mr. Chairman. I will hope to insert in the record the contents in this particular summary booklet which incorporates these items. If there are some items that are not incorporated here, I will be most glad to supply those, too, but they indicate,

for example, our Saltonstall-Kennedy contracts plus the amount of funds that are contracted out to institutions.

The CHAIRMAN. We will meet, then, at 10 o'clock Monday morning, and continue with you as the first witness.

Mr. ALLEN. Mr. Chairman, may I ask a question off the record?

The CHAIRMAN. Yes, sir.

(Discussion off the record.)

The CHAIRMAN. Very well, then; we shall adjourn at this time, and will meet again at 10 o'clock Monday morning.

(Thereupon, at 12:45 p. m., the committee adjourned to meet again at 10 o'clock, Monday, January 13, 1958.)

REVIEW OF FISH AND WILDLIFE SERVICE

MONDAY, JANUARY 13, 1958

HOUSE OF REPRESENTATIVES,
COMMITTEE ON MERCHANT MARINE AND FISHERIES,
Washington, D. C.

The committee met at 10 a. m., Hon. Herbert C. Bonner (chairman) presiding.

The CHAIRMAN. The committee will come to order.

This morning the committee will continue the testimony of Mr. McKernan, Director of the Bureau of Fisheries of the Fish and Wildlife Service.

STATEMENT OF DONALD McKERNAN, DIRECTOR, BUREAU OF FISHERIES, FISH AND WILDLIFE SERVICE, DEPARTMENT OF THE INTERIOR—Resumed

Mr. MCKERNAN. Thank you, Mr. Chairman. During the course of testimony on Friday you requested some specific information concerning contracts negotiated through the Saltonstall-Kennedy Act funds. We have prepared a detailed list of these particular negotiated contracts. I would be pleased to put it into the record with your permission.

BUREAU OF COMMERCIAL FISHERIES

Contracts negotiated with Saltonstall-Kennedy Act funds

	Fiscal 1955	Fiscal 1956	Fiscal 1957	Fiscal 1958
Research on methods of handling, freezing, and packaging southern oysters:				
Louisiana State University	$10,000	$10,000	$10,000	
Tulane University	7,600	7,600	15,125	
Florida State University	12,400	13,100	15,055	
University of Maryland				$10,700
Total	30,000	30,700	40,180	10,700
Development of voluntary standards:				
National Fisheries Institute	30,000	55,000	55,000	55,000
University of Washington	9,785	10,000	10,000	18,800
Massachusetts Institute of Technology	15,900	15,000		
California Department of Fish and Game	10,000			
University of Massachusetts	14,898			
University of Florida	6,000			
Philip R. Parks Foundation, San Pedro, Calif		8,000	10,000	18,840
University of Maryland			75,000	
University of Miami		19,900		
Total	86,583	107,900	150,000	91,840

Contracts negotiated with Saltonstall-Kennedy Act funds—Continued

	Fiscal 1955	Fiscal 1956	Fiscal 1957	Fiscal 1958
Quality index for fishmeal and new uses for fish oils:				
Maryland State College	$5,800			
University of Minnesota	53,832	$48,900	$49,000	
University of Delaware	44,690	25,000	10,009	
North Carolina State	9,700	13,500	10,000	$16,400
Texas A. and M	5,900			
University of Cincinnati	16,000	10,000	20,000	
Florida Southern College	5,240	5,400	6,000	
University of Connecticut	8,000			
University of Southern California	6,820			
Oregon State College	7,375			
Arthur D. Little Co., Boston	16,500			
Reedville Oil and Guano Co., Reedville, Va	6,500			
University of California		20,900	30,000	
University of Wisconsin		5,000	5,000	
Alaska Fisheries Experimental Commission		6,000		
University of Massachusetts		3,960		
Total	186,357	138,660	130,009	16,400
Radiation preservation:				
University of Maryland			15,006	
Oregon State College			13,000	
Massachusetts Institute of Technology			24,950	
Food, Chemical, and Research Laboratory, Seattle			13,000	
Florida State University			14,200	
Total			80,150	
Surveys on fish consumption, marketing, production, distribution, insurance, etc.:				
University of Miami	12,000			18,985
Federal Trade Commission	9,600	7,416		
Harwell, Knowles & Associates, Inc., Coral Gables, Fla	6,226			
First Research Corp., Inc., Miami, Fla	18,700			
A. C. Nielsen Co., Chicago, Ill	13,784			
Bureau of the Census	40,400	11,500		
Northeastern University, Boston	15,720			
Boston University	70,000			
Oregon State College	49,950			
A. J. Wood & Co., Philadelphia	24,950			
University of Miami (Marine Laboratory)	14,000	20,500		
Department of Agriculture		3,000		
W. R. Simmons & Associates, Inc., New York		22,500	3,600	
Boston College		25,000		
University of Washington		25,000		39,700
Maine Department of Sea and Shore Fisheries				25,000
Rutgers University, New Jersey				29,700
In process (basic marketing patterns, 2 to 3 years)				150,000
Total	275,330	89,916	3,600	263,385
Biology of shrimp:				
Tulane University (2 years)	17,100		14,000	
University of Texas (2 years)	27,830			
Texas A. and M. Research Foundation		7,200		
University of Miami				27,400
Total	44,930	7,200	14,000	27,400
Biology of oysters:				
Florida State University	8,600			
Oyster Institute of North America, Annapolis (3 years)	44,200			
Virginia Fisheries Laboratory (3 years)	26,200			
University of North Carolina (3 years)	18,300			
Total	97,300			
Biology of salmon:				
University of Washington, FRI	127,900	114,800	131,600	60,600
Alaska Department of Fish and Game	25,000	4,000	4,000	
University of British Columbia	2,750			
University of Buffalo			8,000	
University of Washington				10,300
In process (4 contracts)				50,000
In process (salmon diseases)				7,500
Total	155,650	118,800	143,600	128,400
Biology of sponges: University of Miami	20,000	12,000		

Contracts negotiated with Saltonstall-Kennedy Act funds—Continued

	Fiscal 1955	Fiscal 1956	Fiscal 1957	Fiscal 1958
Biology of menhaden:				
Gulf Coast Research Laboratory, Ocean Springs, Miss.			$100,000	
Tulane University			11,000	
Total			110,000	
Oceanography and meteorology:				
Texas A. and M. Research Foundation	$1,500			
Woods Hole Oceanographic Institute (3 years)	200,000			$80,000
Scripps Institute of Oceanography		$35,000	630,000	
University of Michigan			15,000	
Total	201,500	35,000	645,000	80,000
Biology of blue crabs: Oyster Institute of North America, Annapolis			80,000	
Biology of king crabs:				
University of Southern California			62,448	
Alaska Department of Fish and Game			14,650	
University of Washington				28,070
Total			74,098	28,070
Fish culture: University of Oklahoma	38,200		40,000	
Handbook of fishery data: National Academy of Sciences	15,000			
Educational and training films and other consumer education mediums:				
Lee Productions, Inc., New York	25,000			
De Luxe Studios, New York	24,000			
Byron, Inc., Washington, D. C	13,000			
Sundial Films, New York			25,000	
Milner Productions, Baltimore			25,000	
Government Printing Office			50,000	
Total	62,000		100,000	
Exploratory fishing and gear research:				
Gulf Marine Ways, Pascagoula, Miss.	39,000			
Steam Ways Corps, Tampa, Fla	83,950			
Vessel Charter, Maine			40,000	
Vessel Charter, Florida			29,200	
Vessel Charter, Gulf of Mexico			40,000	
Dwight Simpson Co., Boston			15,000	
Ebasco Services Inc., New York				25,000
Total	122,950		124,200	25,000
Grand total	1,335,800	540,176	1,655,837	671,195

Contracts negotiated with regular funds, fiscal year 1958

Biology of salmon:	
University of Washington, FRI	$198,000
Washington State College	6,000
Total	204,000

The CHAIRMAN. Suppose you read them off. We would like to know what the results of these contracts have been.

Mr. MCKERNAN. All right, sir.

Some of those results can be mentioned as we go through our slides, if you like.

The CHAIRMAN. Have you been inserting that in your testimony as you went along?

Mr. MCKERNAN. Not specifically, sir.

The CHAIRMAN. I did not recall hearing any mention of any particular study and the result of it. Let us see how long they will run.

Mr. McKernan. Research on methods of handling, freezing, and packaging of southern oysters, for example, there is a contract with Louisiana State University for $10,000 which has been running and this year is its third year that we have had that particular contract.

There are 126 of these, Mr. Chairman. Shall I read them all or indicate some of the special major accomplishments? Also on the booklet that was supplied on Friday—I am sure copies are here today for your reference—on page 53 are listed some major accomplishments of these Saltonstall-Kennedy activities, some of which have been accomplished through research by our own staff and some of which have been accomplished through contracts with outside organizations, universities, and State organizations.

The Chairman. I did want to hear something about these contracts. I am surprised to find there are this many. How many did you say there are?

Mr. McKernan. Thirty-four percent approximately of all of the funds from the Saltonstall-Kennedy funds have been contracted out, Mr. Chairman. The remaining work is being carried on by our own staff.

The Chairman. What does this amount run annually?

Mr. McKernan. Approximately $4.8 million.

Mr. Anderson. This next fiscal year will be about 4.8. Previously it has run from about 4.2 to 4.6.

Mr. Allen. May I ask a question?

The Chairman. Yes.

Mr. Allen. As indicated on page 4, why would the University of Southern California undertake a study of the biology of king crabs?

Mr. McKernan. Because the University of Southern California has had a specialist on crab research that we sought out. He was a man unique in that respect. We contracted with him because of his own unique specialty. This is one of the things we have sought to do in every case, to pick out specialists that we did not have on our own staff or that were available without our adding additional personnel. This particular man had published a great deal of studies on crab research in general, not particularly king crab, you understand, Mr. Allen, but crab research.

Mr. Allen. I take it there is no necessary connection between the location of the problem and location of the study.

Mr. McKernan. Southern California actually provided a staff which went to Alaska during the summertime and were on the grounds during the summer field season.

Mr. Chairman, I have some slides on Alaska and other phases of our work including some Saltonstall-Kennedy projects.

The Chairman. You have these projects listed. Do you have any memorandum on the results of them?

Mr. McKernan. On page 53 of the booklet that was submitted Friday—and I believe a copy is available today—there are some major accomplishments listed. In addition to that, Mr. Chairman, each particular year there is an annual report of the Secretary of the Interior entitled "Research and Activities under the Saltonstall-Kennedy Act." That is issued each fiscal year and in considerable detail; the contracts and projects, each individual project, is listed with the accomplishments for that particular fiscal year.

The contracts that are active at the present time, including those particular projects that are being carried out by our own staff, are started at page 55 of this booklet that has been supplied you for your reference also. That is entitled "The Programs and Allocations under the Saltonstall-Kennedy Act, Fiscal Year 1958."

The CHAIRMAN. I am going to let you go on because you might have to come back here. I want to find out something about this business. Here is Quality Index for Fish Meal and New Uses for Fish Oil, 16 different studies. It amounts to $187,357 a year. I would like to know about this. I believe in research and development. You have one here, Survey on Fish Consumption, 18 studies on that.

Mr. GROSS. What page is that on, Mr. Chairman?

The CHAIRMAN. This list showing these various studies. What does the Development of Voluntary Standards mean?

Mr. MCKERNAN. I mentioned in connection with the New England industry and showed a slide where we worked closely with the industry to develop quality standards for fisheries products. We believe that one of the basic problems with the commercial fishing industry today is the matter of the quality of the product that reaches the consumer. We have been attempting to work cooperatively with the industry to develop voluntary standards. These standards are—we have five that are either finished, completed and now in use, or in process of being completed and under adoption. These standards, we worked them out in our laboratories and through contracts, with the advice and assistance and cooperation of the industry, and then when adopted, of course, the ultimate aim is to improve the quality of fisheries products and thereby eventually increase the consumption through increasing the acceptance by the American housewife.

The CHAIRMAN. I notice here on page 3, Biology of Salmon. I thought all the salmon was in the Pacific Northwest. The University of Buffalo—why was that study placed there?

Mr. MCKERNAN. I believe this study at the University of Buffalo——

The CHAIRMAN. I imagine that means Buffalo, N. Y.

Mr. MCKERNAN. Yes. That very likely included the use and advice and experiments by some experts on a certain field who happened to be located at the University of Buffalo. This very likely meant this particular man during the season, during the salmon season, actually entered the field and carried on studies of salmon in the salmon country, in the Pacific Northwest.

But whenever we have contracted with universities we have, in each case, had as one of the criteria for the contracts that the scientists involved have some special knowledge and some special training on a certain phase of research.

Mr. GROSS. Mr. Chairman, would you yield at that point?

The CHAIRMAN. Yes.

Mr. GROSS. Would that also apply to fish culture at the University of Oklahoma?

Mr. MCKERNAN. The project at the University of Oklahoma was in connection with the propagation of catfish, artificial cultivation, and it did involve people with special knowledge in this particular field.

Mr. ALLEN. Mr. Chairman, may I ask a couple of questions?

The CHAIRMAN. Mr. Allen.

Mr. ALLEN. Going back to page 1, with regard to the fish meal and new uses for fish oil, first what percentage of fish meal and fish oil was produced from menhaden and what from other sources?

Mr. MCKERNAN. About 2.4 billion pounds of the total American fisheries production in 1956 went to meal and oil. This amounted to around 600 million pounds of meal itself, most of which came from menhaden and virtually all of this was included in the preparation of both poultry and stock feeds and is fed almost entirely in the agricultural areas of the United States.

It is an interesting thing to note that because of the very high protein content of this meal only about 5 percent of the weight of the diet is fish meal because it is extremely high in protein and also in some of the essential amino acids, some of the vitamins, and unknown growth factors, are present in these particular fish meals. It is one of the best known sources for certain of these amino acids and also certain of the proteins that are essential for both stock and poultry feed.

A great deal of research in agriculture has gone into this particular subject.

Mr. ALLEN. The proportion of the funds of this schedule spent on the fish meal and oils is fairly high. It is curious where the distribution of the product takes place, over what areas.

Mr. MCKERNAN. Yes, we feel that this matter of research on meals and oils is one of the areas where the Government can do basic research that can later be used by both agricultural industry and the manufacturing industry in the case of the fish oils and the distribution of the products themselves—for example, on the west coast almost all the herring meal goes into stock feeds in the western part of the country and distribution of the menhaden meals is in the Midwest primarily, in the heavy stockraising areas in the Midwest.

Mr. ALLEN. Thank you.

The CHAIRMAN. On page 2, Survey on Fish Consumption, it appears that in 1955 they spent quite a bit of money and in 1956 they did not spend half as much. How does that happen?

Mr. MCKERNAN. These particular funds sometimes are contracted for just, for example—I use this as an example only, Mr. Chairman—the University of Miami, $12,000 in 1955, might have been a 2-year study. That is, the contract might have been let to the University of Miami for a certain phase of fish consumption, perhaps, for example, shrimp marketing or shrimp production in a certain part of the South, and that very possibly could have been allotted for a 2-year period. Some of these contracts are let on a 2-year basis with these educational institutions.

The CHAIRMAN. There is the University of Boston with $70,000 in 1955. Does that mean that $70,000 was contracted to run over so many years?

Mr. MCKERNAN. Are you speaking about the Boston University contract?

The CHAIRMAN. Yes.

Mr. MCKERNAN. Yes, the Boston University contract was let for an insurance study and it was actually let to complete this study of the insurance problem with respect to the New England ground fish industry and on Friday I showed at least two slides dealing with the frequency of occurrence of accidents both with respect to hull damage

and also personal injury in New England. Those particular figures I used were as a result of this particular study by Boston University.

The CHAIRMAN. What did you derive from that in the way of benefit?

Mr. MCKERNAN. In the case of New England, one of the biggest problems is the matter of the increase in insurance rates. These insurance rates have assumed rather alarming proportions, have increased manifold in the last 5 or 10 years. The problem facing the industry is how to get these insurance rates down to a reasonable basis. So this particular study by Boston University was to find out exactly in what areas these insurance rates had increased most drastically and also where the frequency of occurrence was both with respect to the ships themselves and the people, what facilities, equipment on the boats, were causing these particular accidents, and why and at what rate and for what reasons these insurance rates had increased so drastically. We had a report.

The CHAIRMAN. What was the result of this study?

Mr. MCKERNAN. The result was that Boston University wrote a report to us on this particular study. We have taken that report and analyzed it and we are attempting now to implement a safety program in New England.

The CHAIRMAN. So as to reduce the insurance rate.

Mr. MCKERNAN. Yes. We have not yet.

The CHAIRMAN. That was in 1955.

Mr. MCKERNAN. We got that report less than—well, I would judge less than 6 months ago that report was submitted to us. We have implemented the findings of this report first with additional studies in areas not covered by the report and, second, with a program of both safety and education in New England designed to reduce the insurance rates on vessels and reduce the property and indemnity insurance rates. We are hoping through this means to help this particular industry that is in such serious economic straits today.

Mr. RAY. May I ask a question, Mr. Chairman?

The CHAIRMAN. Yes.

Mr. RAY. To what extent do you expect to be able to reduce the insurance costs?

Mr. MCKERNAN. We have held conferences with the insurance underwriters of various major companies and they inform us that, with a program of proper inspection and proper insurance covering these particular high-risk areas of both vessels and equipment on the vessels, that they are perfectly willing to consider the reduction of insurance rates. In fact, they are confident insurance rates will be reduced through such a program. They have informed us of this.

Mr. RAY. Have you any estimate of the amount of savings?

Mr. MCKERNAN. They won't tell us exactly the amount, the individual amounts, that they will reduce insurance rates; they are waiting to see what the frequency of loss is. For example, they mentioned that one of the companies in the last year that had sold insurance in New England had had a ratio of payment to loss, or rather payments for claims to the amount taken in by the company, of 125 percent. In other words, for every dollar they took into the insurance company they paid out $1.25. So they simply said, obviously, this is uneconomic and they got out of the insurance business.

Now most of the insurance that is taken by the fishing boats is very high-cost insurance and much of it is through Lloyd's of London because our own insurance companies are unwilling to insure the boats in New England.

Mr. RAY. Have you worked out figures for yourself as to what you think the savings might be as a result of this?

Mr. MCKENNAN. Yes, and we have approached it this way: Where insurance costs for these boats averaged between six and eight thousand dollars a relatively few years ago—I am only talking about 5 or 6 or even less than 10 years ago—they are now running $15,000 and in some instances $20,000. We hope to actually reduce these rates perhaps as much as 50 percent or even more by such a program.

Mr. RAY. Thank you.

Mr. PELLY. You will recall that in the latter part of the last session there was legislation before this committee having to do with experimenting in the cultivating of fish in rice paddies in Arkansas.

Mr. MCKERNAN. Yes.

Mr. PELLY. About $500,000 was asked for. I do not recall the amount.

I was wondering why the funds under this Saltonstall-Kennedy Act could not be used for such experiments without special legislation.

Mr. MCKERNAN. I think in all likelihood, with the proper draft of a proposal, they very possibly could be. I am not sure that my answer to this question in this offhand manner would be correct but I suspect such a project could be implemented through Saltonstall-Kennedy funds.

Hon. W. F. NORRELL,
House of Representatives,
Washington, D. C.

NOVEMBER 2, 1956.

MY DEAR MR. NORRELL:

* * * * * * *

At the time of my visit in your office I told you I would communicate with you as soon as some decisions had been reached on the use of Saltonstall-Kennedy funds for fish-rice research projects. The Service is still in the process of evaluating the many recommended projects, but it is apparent that fish-rice projects must be placed too low on our priority list to make funds available at this time.

In some areas of the United States there already exist surpluses of certain fresh-water fishes. Increased production, either by increased pond acreage or more efficient culture methods, could result in serious marketing problems. For these reasons, it is not possible at this time to rate your proposal sufficiently high to insure early action.

Although these projects do not seem to merit financing at the present time, they will remain active for further consideration.

* * * * * * *

Sincerely yours,

JOHN FARLEY,
Director, Fish and Wildlife Service.

DEPARTMENT OF THE INTERIOR,
OFFICE OF THE SECRETARY,
Washington, D. C., August 20, 1957.

Hon. HERBERT C. BONNER,
Chairman, Committee on Merchant Marine and Fisheries,
House of Representatives, Washington 25, D. C.

DEAR MR. BONNER: Your committee has requested a report on S. 1552, to authorize the Secretary of the Interior to establish a program for the purpose of carrying on certain research and experimentation to develop methods for

the commercial production of fish on flooded rice acreage in rotation with ricefield crops, and for other purposes.

This bill has been amended in the Senate consistently with the suggestions made in our report to the Committee on Interstate and Foreign Commerce, United States Senate, and we would be agreeable to the enactment of this proposed legislation. In this connection, however, we note that the comparatively recent Fish and Wildlife Act of 1956 (70 Stat. 1119) contains authority to perform the type of functions to which this bill relates.

In our opinion, the objectives of S. 1552 are sound and important. There are about 100,000 acres of ricelands in Arkansas alone, on which fish are being raised as a crop. There are a million acres of ricelands in the South which are, potentially, producers of sport and commercial fisheries. Among the deterrents to improved fish production on these lands are the following:

1. The laws of most States prohibit the sale of certain species of fish designated as game fish; however, these are the most desirable and most marketable species.
2. Uncertain or lack of reproduction of desirable species in ponds.
3. Lack of knowledge for diagnosis, prevention, or treatment of diseases of warm-water fish.
4. Limited marketability of common pond fish, such as carp and buffalo, which are nongame species.
5. Lack of technological advances in preparation, packaging, storage, and merchandising of fresh-water pond fish.

All of these deterrents may be removed, at least in part, by remedial State legislation, biological and technological research, and market development efforts.

We have been advised by the Bureau of the Budget that there would be no objection to the submission of this report to your committee, but that such advice should not be construed as reflecting any commitment as to the necessity of any appropriations beyond those contained in the 1958 budget to carry out the purposes of the proposed legislation if enacted.

Sincerely yours,

ROGER ERNST,
Assistant Secretary of the Interior.

DEPARTMENT OF THE INTERIOR,
OFFICE OF THE SECRETARY,
Washington, D. C., July 5, 1957.

HON. WARREN MAGNUSON,
Chairman, Committee on Interstate and Foreign Commerce,
United States Senate, Washington, D. C.

DEAR SENATOR MAGNUSON: Your committee has requested a report on S. 1552, to authorize the Secretary of Agriculture to establish a program for the purpose of carrying on certain research and experimentation to develop methods for the commercial production of fish on flooded rice acreage in rotation with ricefield crops, and for other purposes.

If amended as suggested in this report, we would be agreeable to the enactment of this proposed legislation. In this connection, however, we note that the comparatively recent Fish and Wildlife Act of 1956 (70 Stat. 1119) contains authority to perform the type of functions to which this bill relates.

In our opinion, the objectives of S. 1552 are sound and important, but its designation of the Department of Agriculture as the administrator of the program would be inconsistent with the principle contained in section 6 (a) of the Fish and Wildlife Act of 1956. This section of the act directs the transfer from other departments of those functions relating "primarily to the development, advancement, conservation, and protection of commercial fisheries; * * *." In the circumstances, because this proposed legislation involves primarily matters of research and experimentation concerning fishery matters, enactment of this bill in its present form would be a backward step toward dividing fishery functions between agencies and providing for overlapping and duplication.

There are about 100,000 acres of ricelands in Arkansas alone, on which fish are being raised as a crop. There are a million acres of ricelands in the South which are, potentially, producers of sport and commercial fisheries. Among the deterrents to improved fish production on these lands are the following:

1. The laws of most States prohibit the sale of certain species of fish designated as game fish; however, these are the most desirable and most marketable species.
2. Uncertain or lack of reproduction of desirable species in ponds.

3. Lack of knowledge needed for diagnosis, prevention, or treatment of diseases of warm-water fish.

4. Limited marketability of common pond fish, such as carp and buffalo, which are nongame species.

5. Lack of technological advances in preparation, packaging, storage, and merchandising of fresh-water pond fish.

All of these deterrents may be removed, at least in part, by remedial State legislation, biological and technological research, and market development efforts. The objectives of this proposed legislation could be accomplished most effectively under the terms of this bill and in a manner consistent with existing legislation by authorizing this Department to accomplish the research and by providing for coordination and cooperation by the Department of Agriculture in these matters.

We suggest, accordingly, the following amendments to this bill:

(1) On page 1, line 3; on page 2, line 19; and on page 3, line 7, strike out the word "Agriculture" and substitute in lieu thereof the words "the Interior."

(2) Page 1, lines 4 and 5, strike out the words "contract with the University of Arkansas for the establishment of" and insert in lieu thereof "establish."

While we believe that this work should be conducted in cooperation or by contract with the University of Arkansas if it can be accomplished most effectively in that manner, we believe it is not in the public interest to restrict the means for such accomplishment, particularly until a sufficient study has been made to determine the best method of accomplishing the object in question.

(3) Page 3, lines 3 and 4, strike out the words "The United States Fish and Wildlife Service of the Department of the Interior," and substitute in lieu thereof the words "The Department of Agriculture."

(4) Amend the first line in the title of the bill by striking out the word "Agriculture" and inserting in lieu thereof "the Interior."

There is enclosed a copy of supplementary information on fish farming, also requested by your committee.

We have been advised by the Bureau of the Budget that there would be no objection to the submission of this report and supplementary information to your committee, but that such advice should not be construed as reflecting any commitment as to the necessity of any appropriations beyond those contained in the 1958 budget to carry out the purposes of the proposed legislation if enacted.

Sincerely yours,

HATFIELD CHILSON,
Under Secretary of the Interior.

There are no changes in existing law.

Mr. PELLY. Do you recall if the Department favored that particular legislation at the time?

Mr. MCKERNAN. Yes, I do.

Mr. PELLY. Thank you.

Mr. GROSS. Mr. Chairman.

The CHAIRMAN. Mr. Gross.

Mr. GROSS. May I ask what is the Gulf Coast Research Laboratory, Ocean Springs, Miss.? Is that privately operated? It is on page 3. $100,000 in fiscal 1957.

Mr. MCKERNON. Yes. As I remember that is a laboratory operated—the chief scientist is Dr. Gordon Gunter. It is a State laboratory.

Mr. GROSS. Is it operated by the State or is it a private laboratory?

Mr. MCKERNAN. I understood you to ask whether it was Federal. It is a State laboratory.

Mr. GROSS. Are there any other funds in addition to those contracts out of Saltonstall-Kennedy Act funds, any other consultants hired not here listed for any other purpose in connection with the Bureau of Commercial Fisheries?

Mr. MCKERNAN. Paid for out of Saltonstall-Kennedy funds?

Mr. GROSS. Yes.

Mr. McKernan. Not to my knowledge.

Mr. Gross. Are there any other consultants hired out of any other funds?

Mr. McKernan. Yes, there have been in the past for special circumstances consultants hired. I happen to have knowledge of one myself, Dr. Richard Van Cleve, director of the University of Washington School of Fisheries, was hired for some special consulation work with respect to the Alaska research program. When we implemented the research program in Alaska with Saltonstall-Kennedy funds, we though it advisable to make sure that we had the proper amount of consultation for this rather major program. This particular man is one of the world's authorities on salmon and we thought it was economic for us to have our program thoroughly reviewed by an independent reviewer. We hired him for that purpose on a pay-as-he-worked basis.

Mr. Gross. From what funds was he paid?

Mr. McKernan. I am quite certain he was paid out of our regular appropriations. It only amounted to a matter perhaps of $1,500 or $2,000 for the year. I cannot tell you the exact amount.

Mr. Gross. Is he the only one?

Mr. McKernan. I am not sure. I cannot tell you specifically. I will be glad to provide that information if you care to have it, but it is not a usual thing to do, but under certain circumstances we do hire specialists in most instances either to review active research programs to give us another slant on whether these programs are being designed and operated properly or to review publications which are being suggested for publication. That is, to some extent we hire outside people to simply edit these publications to make sure that any special kind of research report has considered all elements in the editing of it before it is published.

Mr. Gross. You have not yet felt the need of hiring a firm of private consultants on personnel matters?

Mr. McKernan. We have not hired a firm of private consultants. We have actually discussed this matter among our own particular staff and have felt that perhaps in certain respects to review the Bureau program it might be advisable but we have not done so.

Mr. Gross. You have personnel management people, don't you?

Mr. McKernan. Yes, we do. The Department does.

Mr. Gross. This is a rather new agency, is it not?

Mr. McKernan. Yes.

Mr. Gross. I hope you will not get into the rut that many other bureaus and agencies and departments of Government have gotten into, which is to go beyond your own personnel and hire private consultants to tell you how to handle your employees.

Mr. McKernan. I am glad to have your views on that.

Mr. Gross. That is a tremendous bill of expense for the Government. It is my opinion we should make use of the personnel people in the various departments or admit that they cannot handle personnel problems and get rid of them. If you are going to bring in private management firms to tell you how to handle your personnel, let us get rid of the expense involved in maintaining personnel people in the various departments.

That is all I have, Mr. Chairman.

The CHAIRMAN. The total to date on fish consumption is 363,000 plus. Does any other agency get out a report on consumption of foods?

Mr. MCKERNAN. Yes, the Department of Agriculture, I am sure, does this to a much greater extent than the Department of the Interior.

The CHAIRMAN. Is this a duplication of what the Department of Agriculture does?

Mr. MCKERNAN. No; in no respect.

The CHAIRMAN. What is the difference?

Mr. MCKERNAN. This deals entirely with respect to fish.

The CHAIRMAN. Do they get out a publication on the marketing of fish?

Mr. MCKERNAN. No.

Mr. YOUNG. Mr. McKernan, I am addressing myself to the shrimp situation that I spoke to you briefly about in connection with the gulf coast.

I know you are thoroughly familiar with that area but, for the benefit of some of the members of the committee that may not be, along what is known as the coastal bend of Texas is a string of low sand islands and behind these islands are probably the best natural spawning grounds of fish and shrimp, et cetera, to be found anywhere in the world. Do you agree with that?

Mr. MCKERNAN. Yes.

Mr. YOUNG. These islands are interrupted with natural passes at certain spots that respond to changes in climatic conditions. Hurricanes frequently close up those.

Every authority I have had the pleasure to discuss the situation with—the chairman of this committee, Mr. Bonner, and Mr. Boykin, the chairman of my subcommittee, authorized me to hold hearings in that area during the recess—every authority recognizes that the passes are indispensable to the production of shrimp, that at certain times of the year the shrimp go through these passes in countless numbers, and that with the passes being closed, the shrimp, of course, cannot get in.

That is in a great measure responsible for the short supply of shrimp in the upper reaches of the gulf and bears directly on the international situation we have off of Campeche which this committee recognized in the first session of this Congress and reported out favorably a bill to indemnify the shrimpers for loss of equipment in Campeche, recognizing the problem of the short supply of fish that exists.

I am disappointed to see there is not more money spent on investigation of the biology of shrimp.

Is it not a fact that your Department recognizes the need for the so-called fish passes through these islands as a proposition of maintaining a constant supply of these shrimp?

Mr. MCKERNAN. Yes, Mr. Young; we certainly do. We look upon the present development and utilization of some of these estuarian areas in the gulf coast by multiple-purpose projects of various kinds very seriously. Not only are there great shrimp resources involved, but also oysters and menhaden because all three of these major species, the three most important species in the entire gulf, depend upon these brackish water areas for a portion of their life history. In

cutting off these channels and changing the makeup of these bays and estuarian areas I think that the entire fishery resources of the gulf are endangered. We look upon this as one of the most important problems facing us today.

I should like to mention to you that we are spending considerable amounts of money on this subject. Please remember that this particular summary provided to you here is only those projects that are contracted to outside agencies. We are spending Saltonstall-Kennedy funds, and our own funds also, on shrimp research in the gulf. In fact, this whole program of shrimp in the gulf is being expanded and we are studying thoroughly our past program and what is needed at the present time. This matter of studies on the estuaries is receiving a very, very high priority in our whole scheme of things.

Mr. YOUNG. Mr. McKernan and members of the committee I would like to point out there were at one time 20 some odd natural passages in these islands. They cover approximately 350 miles. At one time there were 20 some odd natural passes and today there are less than five.

Is it not a fact it would be a worthwhile project to contemplate the construction of say two experimental passes, opening of experimental passes where natural passes had existed before, and have biologists go in and check the shrimp passage and see what effect it has? I believe we are passing up one of the best bets in the world to increase shrimp supply in the upper reaches of the gulf.

Do you agree with that statement?

Mr. MCKERNAN. I certainly believe that very close attention should be given to this particular problem and that it certainly is our responsibility to see that more research and a greater amount of knowledge is supplied in this problem. Not only are these passes themselves affected, but the environment on the inside waters is affected, the salinity of the water, in fact the physical characteristics of these inland areas so vital to the larval life histories of these species is concerned.

Mr. YOUNG. If we preserve the balance of salinity, we have to have these passes or these fine spawning grounds will not be able to support any marine life; is that correct?

Mr. MCKERNAN. Yes.

Mr. YOUNG. Thank you.

Mr. ALLEN. Could you tell us how as a practical matter the list of projects for which Saltonstall-Kennedy funds are supplied is made up?

Mr. MCKERNAN. Yes. There are several ways that Saltonstall-Kennedy projects are submitted to us. Perhaps you gentlemen will remember that an advisory committee was indicated as being advisable when the bill was drafted. This particular Saltonstall-Kennedy Advisory Committee is made up of citizens and industry members from various parts of the country. They advise the Secretary of the Interior with respect to major policy areas, policy areas to be considered in the allocation of these projects. Most of them are practical fish producers, fishermen, fishing boat owners and processors. But the projects themselves, some of them come from our particular project leaders and some of them come from universities and individuals who believe they have certain knowledge of certain skills which would lend itself to the solution of some of our important problems.

UNITED STATES DEPARTMENT OF THE INTERIOR

FISH AND WILDLIFE SERVICE

Project No. (leave blank)

Date:

[Instructions]

PROPOSED PROJECT UNDER SALTONSTALL-KENNEDY ACT (68 STAT. 376)

1. Major field: (Leave blank.)
2. Title of project: (Give brief but clearly descriptive title.)
3. Proposed by: (Give name and address of organization making proposal, including name and title of official submitting proposal.)
4. General description (Briefly, what is the problem? Why should it be undertaken? What are the objectives? Who will benefit and in what way?)
5. Method of procedure: (How will the project be undertaken?)
6. Work to be performed by: (What organization should do the suggested work? If same as in 3 above, give brief description of personnel and facilities available.)
7. Estimated duration of the project:
8. Estimated costs: (Tabulate on annual basis and include salaries, expenses, overhead, buildings, maintenance.)

(Limit each project description to space provided on form. Submit in duplicate.)

As to those projects, we have a regular form involved that is sent out to these people and they make out the projects and send them in. We have a committee within our own staff, and this particular committee is made up of members of our staff within the various divisions. Taking the guidelines, policy guidelines, laid down by the Saltonstall-Kennedy Advisory Committee members, we attempt in an objective manner to assess the importance of these projects and give them orders of priority.

CRITERA FOR EVALUATION OF PROPOSED PROJECTS UNDER THE SALTONSTALL-KENNEDY ACT

1. The degree of the emergency or extent of distress in the industry for which the proposal is made.
2. Whether the proposal is national in scope and to what degree it has application to more than local areas and problems.
3. The extent of large-scale capital investment required by the proposal.
4. The substantiality in value, volume and employment in the industry.
5. Extent to which the fishery may be affected by imports.
6. Extent to which the results of the work can be expected to be obtained in a reasonable time.
7. Relative need to fill gaps in knowledge.
8. The degree to which industries or States could do the work requested, rather than the Federal Government.
9. The relative need for the work and prospects for successful achievement.
10. The relation of the cost of the work to the benefits likely to result.
11. The effect of the proposed activity on the balance among major categories of work.

Obviously, there are a great many more projects submitted than can be accepted. There is an area of judgment here. As far as we can do, what we do is try to follow the general guidelines that are supplied, for example both with respect to our own program of definite funds that come from Congress and with respect to the policies that have been laid down by the Secretary of the Interior through his advisory committees. We attempt to be as objective as we can.

Mr. ALLEN. Are there any fairly sizable segments of the industry that are not represented on the advisory committee or any geographical areas not represented?

Mr. MCKERNAN. I believe all geographical areas and for the most part most segments of the industry are represented on the committee. I believe there are allowed some 23 members of the committee—rather, it is 19 members—they are people from various geographical areas as well as various segments of the industry such as fishermen, processors, wholesalers, people from the Midwest, for example, from the Great Lakes region, South Atlantic, Gulf, various areas.

AMERICAN FISHERIES ADVISORY COMMITTEE

Authorized by Act of July 1, 1954 (68 Stat. 376)

Ross Leffler, *Chairman*, Assistant Secretary of the Interior.
William Ballard, president, Ballard Fish & Oyster Co., Inc., P. O. Box 1111 Norfolk, Va. (processor and distributor, fresh and frozen products).
Lawrence Calvert, president, San Juan Fishing & Packing Co., foot of Stacy Street, Seattle 14, Wash. (processor and distributor, canned, fresh, and frozen products).
James S. Carlson, treasurer, Baker, Boies & Watson Co., 36 Fish Pier, Boston 10, Mass. (processor and distributor, fresh and frozen fillets).
Ralph E. Carr, president, Mid Central Fish Co., 1656 Washington Street, Kansas City, Mo. (wholesaler, fresh and frozen products).
Mason Case, manager, Fishermen's Cooperative Association of San Pedro, Berth 73, Fishermen's Building, San Pedro, Calif. (tuna and sardine vessels).
Chris Dahl, Kayler-Dahl Fish Co., Box 1092, Petersburg, Alaska (canner, processor, distributor, fresh and frozen products).
David H. Hart, 101 South Lafayette Street, Cape May, N. J. (fisherman, boat owner).
R. L. Haynie, Jr., president, Reedville Oil & Guano Co., Inc., Reedville, Va. (reduction plant owner and operator).
Leon S. Kenney, president, Pinellas Seafood Co., 1533 Third Street, South, St. Petersburg 5, Fla. (processor and distributor, fresh and frozen products).
John Lewis, president, Twin City Fishermen's Cooperative Association, Inc., P. O. Box 809, Morgan City, La. (shrimp vessel association).
Donald P. Loker, vice president, Star-Kist Foods, Inc., Terminal Island, Calif. (tuna and sardine canner).
James McPhillips, president, McPhillips Packing Corp., Mobile, Ala. (canner, processor and distributor of shellfish).
Arthur H. Mendonca, president, F. E. Booth, Inc., 280 Battery Street, San Francisco, Calif. (canner ad distributor tuna and sardines).
J. Richards Nelson, Elm Street, Madison, Conn. (shellfish grower and distributor).
Moses B. Pike, treasurer, Holmes Packing Corp., Eastport, Maine (Maine sardine canner).
H. F. Sahlman, Sahlman Sea Foods, Box 667, Fernandina Beach, Fla. (vessel owner and shrimp vessel manager, processor and distributor of shrimp).
Thomas F. Sandoz, president, Columbia River Packers Association, Astoria, Oreg. (canner, processor, distributor, fish and shellfish).
Arthur Sivertson, Sivertson Bro. Fisheries, 366 Lake Avenue, South, Duluth, Minn. (fisherman and wholesaler, fresh water fishes).
Lawrence W. Strasburger, 429 Betz Place, Metairie, La. (industry technical consultant).

NORMAN B. WIGUTOFF,
Executive Secretary, Bureau of Commercial Fisheries.

AUGUST 1, 1957.

Mr. ALLEN. Is the advice of the advisory committee controlling to a considerable extent or is it just advice to be considered and followed or not followed according to the desires of the Bureau?

Mr. MCKERNAN. I believe that the Secretary of the Interior takes the position that this is advice and that the Department of the In-

terior cannot be controlled by this advice, but that it should consider it with respect to utilizing the very best talents in our country in this respect.

While the advice of these particular experienced men is not binding on the Department of the Interior, for the most part the Bureau and the Department take the advice rather seriously.

Mr. ALLEN. Are there any instances in which the advice of the advisory committee has not been followed?

Mr. MCKERNAN. So long as the advisory committee has kept along policies which were consistent with the policies laid down by the administration and by Congress, I believe that that advice has been followed. I cannot think of an instance. If I am incorrect about this, I will look it up and be pleased to supply the committee with such instances.

Mr. ALLEN. I have heard complaints lately and perhaps you had better.

DEPARTMENT OF THE INTERIOR,
OFFICE OF THE SECRETARY,
Washington, D. C., April 5, 1957.

MEMORANDUM

To: The Assistant Secretary for Fish and Wildlife
From: The Secretary
Subject: American Fisheries Advisory Committee

The American Fisheries Advisory Committee, appointed by the Secretary of the Interior under the terms of the Saltonstall-Kennedy Act (68 Stat. 376), will hold its next meeting in Biloxi, Miss., April 22 through April 24, 1957.

Establishment of the United States Fish and Wildlife Service by the Fish and Wildlife Act of 1956 (70 Stat. 1119) necessitates amendment, in certain respects, of Secretary McKay's memorandum of March 31, 1955, establishing procedures to be followed by the committee in the performance of its functions. Accordingly, effective as of the date of this memorandum, the Assistant Secretary for Fish and Wildlife shall assume the duties and perform the functions heretofore delegated to the Assistant Secretary, Public Land Management, and the Commissioner of Fish and Wildlife shall assume the duties and perform the functions heretofore delegated to the Director of the Fish and Wildlife Service.

Please send a copy of this memorandum to each member of the committee.

HATFIELD CHILSON,
Acting Secretary of the Interior.

DEPARTMENT OF THE INTERIOR,
OFFICE OF THE SECRETARY,
Washington, D. C., March 31, 1955.

MEMORANDUM

To: Director, Fish and Wildlife Service.
From: Secretary of the Interior.
Subject: American Fisheries Advisory Committee.

As the first meeting of the American Fisheries Advisory Committee is to be scheduled for the near future, it would perhaps be well to set down some of the matters we discussed for the guidance of both the Fish and Wildlife Service and the members of the committee. This committee has been created under the provisions of section 2 of the Act of August 11, 1939 (53 Stat. 1411), as amended by the Act of July 1, 1954 (68 Stat. 376), which provided in part that "in carrying out the purposes and objectives of this section the Secretary of the Interior * * * is authorized to appoint an advisory committee of the American fisheries industry

to advise him in the formulation of policy, rules and regulations pertaining to requests for assistance, and other matters." In the selection of members we have sought to obtain as complete a cross section of the American fisheries industry as is practicable by providing fair representation for independent small, medium, and large enterprises, for different geographical areas, and for different segments of the industry.

The American Fisheries Advisory Committee constitutes a group whose advice will be sought from time to time by the Department on specific problems respecting development of domestic fisheries. Section 2(a) of the 1939 act as amended made available 30 percent of the gross receipts from duties collected under the customs laws on fishery products for expenditure by the Secretary of the Interior,

"(1) to promote the free flow of domestically produced fishery products in commerce by conducting a fishery educational service and fishery technological, biological and related research programs, the moneys so transferred to be also available for the purchase or other acquisition, construction, equipment, operation, and maintenance of vessels or other facilities necessary for conducting research as provided for in this section, and (2) to develop and increase markets for fishery products of domestic origin and (3) to conduct any biological, technological, or other research pertaining to American fisheries."

As there are special problems in connection with industry advisory committees and antitrust laws, I would like to be rather formal and specific in laying down procedures which are to be followed by the committee in performing its functions. The procedures have been formulated in accordance with criteria set forth in a letter dated October 19, 1950, from the Deputy Attorney General to the Secretary of the Interior. A copy of this letter is attached. It is my understanding that the views expressed in that letter still are those of the Department of Justice.

The American Fisheries Advisory Committee will meet upon call of the Assistant Secretary, Public Land Management. Meetings of the committee will be presided over by him or by such an official of the Fish and Wildlife Service as he may designate. While the committee will be asked to meet at least once a year, other meetings will be called when they appear desirable. Meetings will be held in Washington or at suitable places on the Atlantic, gulf, and Pacific coasts, or in the Great Lakes region.

While the Assistant Secretary will welcome suggestions from individual members of the committee as to items which might profitably be discussed, the committee is to consider only those matters which, with the approval of the Assistant Secretary, are referred to it for advice. He will entertain at any time a request from a member that a meeting of the committee be called. In the absence of the Assistant Secretary, Public Land Management, the secretarial officer temporarily performing his duties will act upon matters pertaining to the committee.

The Director of the Fish and Wildlife Service shall designate an employee of the Service to serve as executive secretary to the American Fisheries Advisory Committee. The executive secretary shall be responsible for the preparation, after consultation with the appropriate officials of the Service, of an agenda for each meeting of the committee. Each such agenda shall be submitted to the Assistant Secretary and, when approved by him, shall be sent by the executive secretary to each member of the committee well in advance of the meeting to which the agenda pertains. The executive secretary shall be responsible for the preparation of minutes of each meeting of the committee. The executive secretary shall arrange for provision by the Fish and Wildlife Service of such stenographic assistance as the committee may need in the preparation of any recommendations or reports.

The statutes under which the committee is created provide that the functions of the committee are to be advisory only. Decisions with respect to departmental policies, programs, or actions, of course, will be made by the appropriate officials of the Fish and Wildlife Service or a secretarial officer.

Would you please make sure that each member of the committee is given a copy of this memorandum?

DOUGLAS MCKAY,
Secretary of the Interior.

21168—58——7

DEPARTMENT OF JUSTICE,
OFFICE OF THE DEPUTY ATTORNEY GENERAL,
Washington, D. C., October 19, 1950.

The honorable the SECRETARY OF THE INTERIOR,
Washington, D. C.

MY DEAR MR. SECRETARY: In several instances various Government departments have requested the views of the Department of Justice with respect to whether participation by members of an industry in the activities of industry advisory committees would be considered a violation of the antitrust laws. In view of the recent increase in the number of such requests, it is felt that a statement of the Department's position in this regard might be helpful.

As a general matter we are of the view that the decision as to the necessity for the formation of industry committees to advise a Government department, and the responsibility for their formation, rests with the specific department. However, in organizing such committees, there are certain requirements which should be met in order to minimize the possibility of violation of the antitrust laws. Briefly stated these requirements are:

(1) There must be statutory authority for the employment of such committees or there must be an administrative finding that it is necessary to utilize such committees to perform certain statutory duties.

(2) The agenda for such committees and their meetings must be initiated and formulated by the Government.

(3) The meetings to be held must be at the call of and under the chairmanship of full-time Government officials.

(4) Full and complete minutes of each meeting must be kept.

(5) The functions of such committees must be purely advisory and any determinations of action to be taken must be made solely by Government representatives.

So long as the activities of industry advisory committees are carried on within these limitations, we would not view the activities as constituting an independent violation of the antitrust laws. We wish to emphasize, however, and it should be made clear to participants in such activities, that the Department of Justice retains complete freedom to institute proceedings, either civil or criminal, or both, in the event that any particular plan or course of action is used to accomplish unlawful private ends. Further, this Department retains full freedom to institute civil actions to enjoin continuance of any acts or practices found not to be in the public interest and persisted in after notice to desist.

Yours sincerely,

PEYTON FORD,
Deputy Attorney General.

Does the field of Saltonstall-Kennedy investigation cover or attempt to cover the whole area of fishery problems or are the States also acting independently on their own individual problems?

Mr. MCKERNAN. The States are acting independently with respect to their own problems. For the most part the States that have active research programs use these research programs to determine facts which will lead to the management of their fisheries, that is, that will lead to regulations directly.

They look to the Federal Government for the most part for a sort of a base for their practical research.

With respect to the Atlantic and gulf coast, the Bureau of Commercial Fisheries is the research agency for the Atlantic Coast Marine Fisheries Commission and the Gulf Coast Marine Fisheries Commission. This is under an authorization authority by Congress some few years ago. As the official research organ for these two interstate agencies, the Bureau does carry out research of a management kind, especially in these two areas.

We do the same thing in Alaska, where the entire management responsibility rests with the Federal Government.

Mr. ALLEN. You have left out Great Lakes and west coast.

Mr. McKernan. In the case of the Great Lakes the States are actively working with the Great Lakes Commission and with the Bureau in a research program and lamprey-control program. I have slides and intend to tell you about our progress in the Great Lakes lamprey control program.

Mr. Allen. It occurred to me there are salmon, tuna, and to a certain extent striped bass, and the biggest problem I suppose, or one of the biggest, is the sardine problem.

Mr. McKernan. We are carrying out cooperative programs in all of these areas with the States involved. The State programs in most of these areas tend to be programs which will lead to information for management of the resources.

With respect to the salmon program in the Columbia, our program is entirely maintenance of salmon runs in the face of high-level dams. We have slides on that subject, too.

In the pilchard or sardine this is a rather expensive investigation because it involves oceanography since pilchards are strictly a pelagic fish, a high-seas fish. There is a cooperative program, a rather strong, healthy cooperative program, going on with the State of California and a Marine Research Committee made up of State and industry people, who in a sense act as an advisory committee to coordinate the activities of the research agencies, which study this fishery.

Mr. Allen. Where is the money coming from for that?

Mr. McKernan. There is Federal money involved. We have regular appropriations and a sizable amount of Saltonstall-Kennedy funds for this sardine program. The industry taxes itself to supply some of the funds for the project. In fact, there are State funds or the funds from the special tax funds that the industry taxes itself, I think $60,000 of that is turned over directly to the Bureau to supplement our own funds for these studies. So that the State appropriates funds, industry taxes itself a special tax to provide funds earmarked for this purpose, and then the Federal Government through both regular appropriations as well as Saltonstall-Kennedy funds supports it.

Mr. Allen. With regard to the pilchard, which I think is in the main a California production, what would the percentages be as to the expenditures for that research from the industry, from the State, and from the Federal Government?

Mr. McKernan. I would judge that the State is providing over half of those funds, approximately 60 percent. I do not have that specific breakdown, but I would say we are probably providing 30 percent and about 10 percent from the industry now at the time when the production is low. When the production is higher, the special tax produced a great deal more funds.

Mr. Allen. Thank you.

The Chairman. On page 3 and on the last page — the last page is "Biology of Salmon," $128,000 plus on page 3, and $198,000 on the last page.

This $198,000, is that an additional amount to what is on page 3?

Mr. McKernan. Yes. The $198,000 on the last page is a contract let to the Fishery Research Institute for studies on the high seas for the North Pacific Fisheries Commission, studies of tagging salmon on the high seas. This work is carried out by Dr. W. F. Thompson, a very

famous ichthylogist from the Pacific Northwest. Dr. Thompson charters vessels and is actually tagging salmon out in the mid-North Pacific in the vicinity of the Japanese high seas fishery. That $198,000 is separate from the Saltonstall-Kennedy allotments indicated on page 3. Those particular studies on page 3 for the most part are studies of research from Alaska itself and are designed to provide information upon which the management of the fisheries can be based.

The CHAIRMAN. What attention is paid to the shad and striped bass on the Atlantic coast? I do not see anything in here about that.

Mr. MCKERNAN. There are considerable studies going on on this particular subject.

The CHAIRMAN. I meant on this particular contract tabulation I do not see anything. Where is it on here?

Mr. MCKERNAN. I believe we will find that in the——

The CHAIRMAN. I mean these Saltonstall fund contracts.

Mr. MCKERNAN. I cannot tell you there specifically, I have to look in the detailed allotment of these. On page 58——

The CHAIRMAN. I see it is all spelled out as to what these contracts specifically involve, but I do not see anything about any specific fish, shad or striped bass on the Atlantic coast with respect to Saltonstall-Kennedy funds.

Mr. MCKERNAN. We have a project or we have an active research program on both shad and striped bass. On page 56 of the reference booklet, item 7, about midway in the page, calls for $60,600 for Atlantic striped bass research.

This is a program that was started, I believe, about 1955 and has been a rather active and successful project.

The CHAIRMAN. Where is that being carried on?

Mr. MCKERNAN. I beg your pardon.

The CHAIRMAN. Where is this study being conducted?

Mr. MCKERNAN. This particular study is being carried on in the Roanoke River and Albemarle Sound and it shows populations of striped bass there are almost entirely self-contained. We are studying location of spawning areas. This includes most of the lower 50 miles of the Roanoke River. We are attempting to find the tolerance of the striped bass and the eggs and larvae of the striped bass at various concentrations of pulp mill effluents. There is also the problem of the oxygen.

The CHAIRMAN. What progress have you had?

Mr. MCKERNAN. We have actually found where the spawning areas are located. Right at the present time we are studying the tolerances of the striped bass eggs and larvae. We have not completed those particular studies.

The CHAIRMAN. Any other questions?

Mr. GROSS. Yes, Mr. Chairman.

You spoke of the advisory committee. How is the advisory committee paid?

Mr. MCKERNAN. They are not paid, Mr. Gross. Their per diem at the meetings twice a year is paid at some nominal rate, just their actual expenses.

Mr. GROSS. Plus their transportation?

Mr. MCKERNAN. Plus their transportation.

Mr. GROSS. This is becoming a Government of advisory committees. I picked up the manual the other day and could hardly believe my eyes because of the number of advisory committees we have right down the line, an advisory commission for almost every department and agency of Government.

Now I see that Eric Johnston is going to head up an advisory committee on the foreign-aid program.

I wonder when we are going to stop setting up advisory committees.

Mr. MCKERNAN. The advisory committeee we operate under here has been provided for by Congress.

Mr. GROSS. I am not attempting to say the Congress is not responsible. Certainly Congress is responsible. You would not be spending money on per diem and transportation and neither would any other agency, but I doubt if there is a government in the world that has more advisory commissions than we have.

Mr. MCKERNAN. May I proceed?

The CHAIRMAN. Yes.

Mr. MCKERNAN. We will start with our slides now.

I am very briefly going to discuss with you the matters of Alaska salmon management. This particular resource is one of the largest fisheries resources in the United States, both poundagewise as well as the value of the Alaska fisheries. This is southeastern Alaska where, about a third of a million to as much as 4 million cases of pink salmon and chum salmon are produced.

Mr. TOLLEFSON. Repeat that, please.

Mr. MCKERNAN. From about a half million cases to about 4 million cases of pink salmon and chum salmon are produced in just southeastern Alaska waters.

Prince William Sound area is the next major area of Alaska, and here the production has varied in numbers of fish from about a half million pink salmon to as much as 12 or 13 million pink salmon.

Cook Inlet produces both red salmon or sockeye salmon as well as pink and chum salmon.

The famous Kodiak Island, with its famous Karluk River, pink and chum and sockeye are important.

The Alaskan Peninsula along here is the site of a very intensive fishery for pink salmon and chum salmon especially.

This is the Bering Sea or Bristol Bay portion of the Bering Sea where the world famous Bristol Bay red salmon runs come in. This is perhaps the largest single fishery in the world. Upward of 25 to 30 million of red salmon have been taken here in past years. This particular fishery is being rehabilitated at the present time, and recent runs indicate that we have had considerable success with its rehabilitation.

The headquarters for the Alaska region is in Juneau, which is in the northern part about here. Then there are district headquarters where licenses and enforcement and observation of the spawning, escapement, et cetera, are carried on. Those district headquarters are located at Ketchikan, Juneau, and during the season at Yakutat where important silver and red salmon runs occur. There is a headquarters at Cordova, Anchorage, and Kodiak, a seasonal headquarters at Sand Point and Shumagin and seasonal headquarters for king salmon in the Bering Sea.

We have also been carrying on some studies on the Yukon River and other parts of the Arctic in connection with the North Pacific Fisheries Commission. This North Pacific Fisheries Commission legislation brought about its inception in about 1954. The object was to determine where on the high seas the salmon of North American origin migrated.

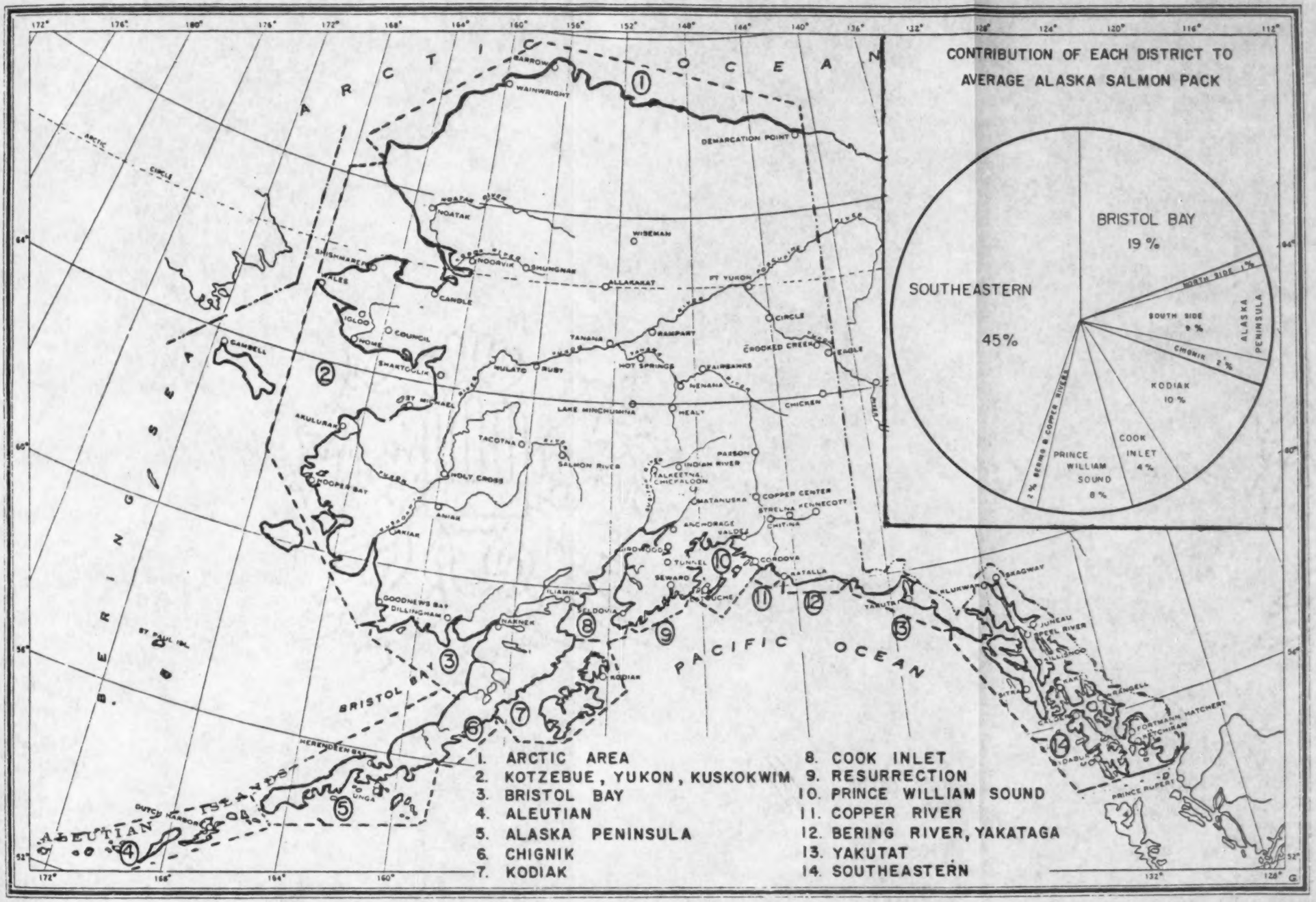
The Japanese, in discussions of this particular legislation, agreed to abstain from fishing for salmon of North American origin, and at that time an arbitrary line of abstention east of which the Japanese agreed not to fish was established. That line was set at 175° west longitude which is 5° east of the international date line.

Mr. TOLLEFSON. Are you going to comment further on the take of salmon by Japanese?

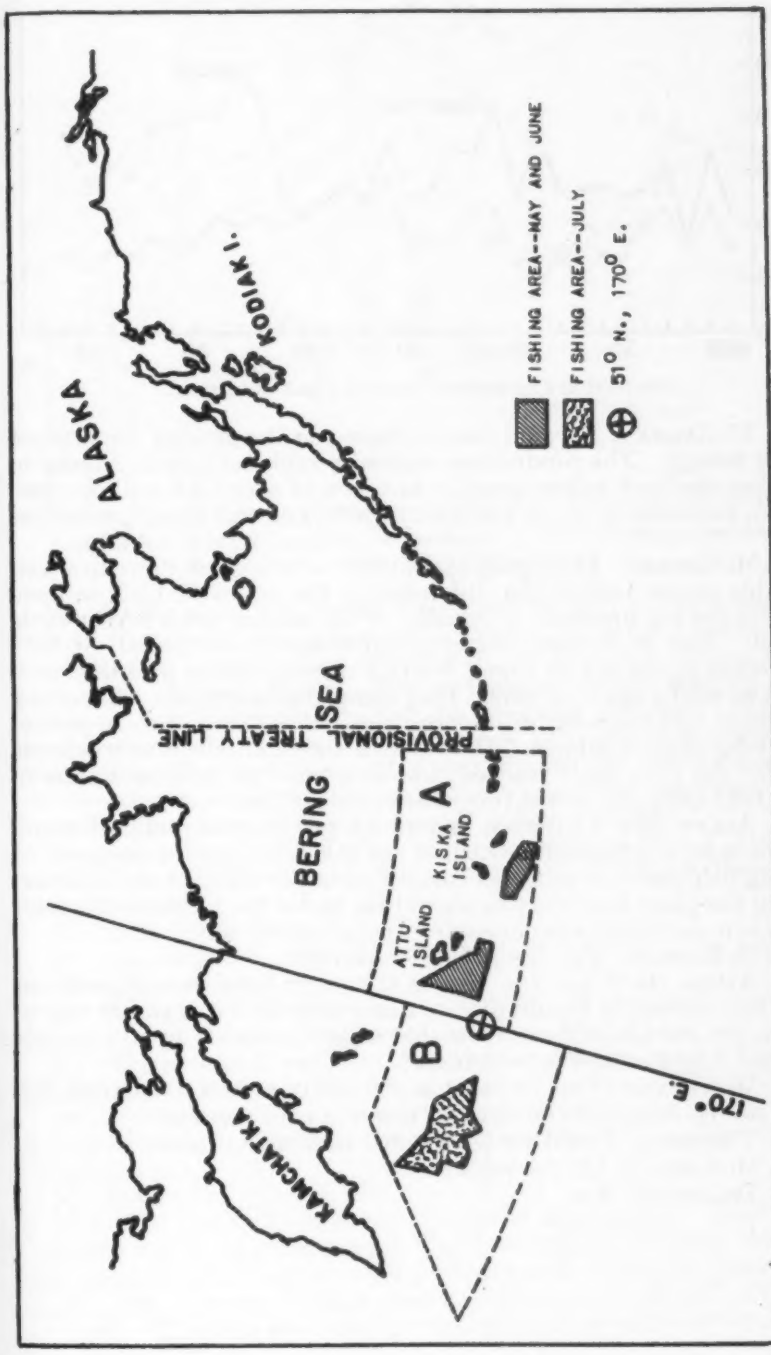
Mr. MCKERNAN. Yes, I am.

Mr. TOLLEFSON. Very well.

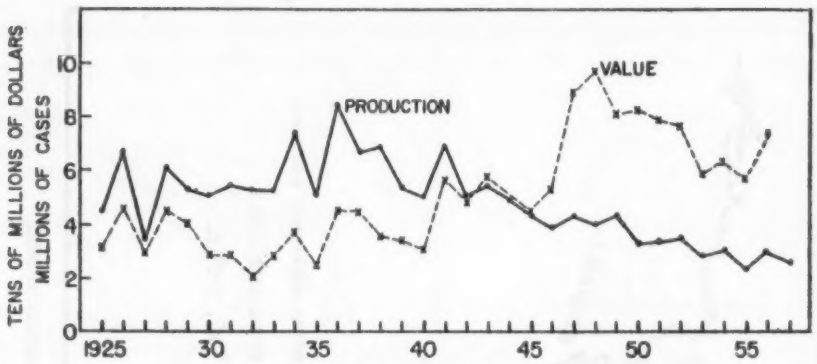
21168 O - 58 (Face p. 98)



MAJOR REGULATORY DISTRICTS IN ALASKA



The North Pacific Ocean and Bering Sea, showing Japanese salmon fishing areas in 1952.



Production and value of canned Alaskan salmon.

Mr. McKernan. I would like to show you the general importance of this fishery. The production reached 8 million cases in Alaska in 1936, has declined rather steadily to a low of about 2.3 million cases in 1955, increased to about 4 million in 1956, and was about 2.4 million cases.

Mr. McKernan. The zigzag appearance of this catch curve to a considerable extent reflects the difference in the cycles of pink salmon, which is the big producer in Alaska. Pink salmon are a 2-year-cycle salmon. That is, salmon that came up to spawn in the fall of 1957 will return to the sea as young fry this coming spring and then will return as adults again in 1959. They complete their entire life history in 2 years, and there are differences in the abundance of these particular cycles of pink salmon. The value of the catch, the first wholesale value of the pack itself reached close to a hundred million dollars in about 1948 and right now is very close to $80 million.

Mr. Allen. Mr. Chairman, before we get that map out of mind, the line is fixed arbitrarily, but is it not also true that the program of tagging fish that you said was carried on is for the purpose of determining the place that the line should be, under the terms of the treaties so as to exclude the Japanese from tagging that way?

Mr. McKernan. Yes, Mr. Allen; that is right.

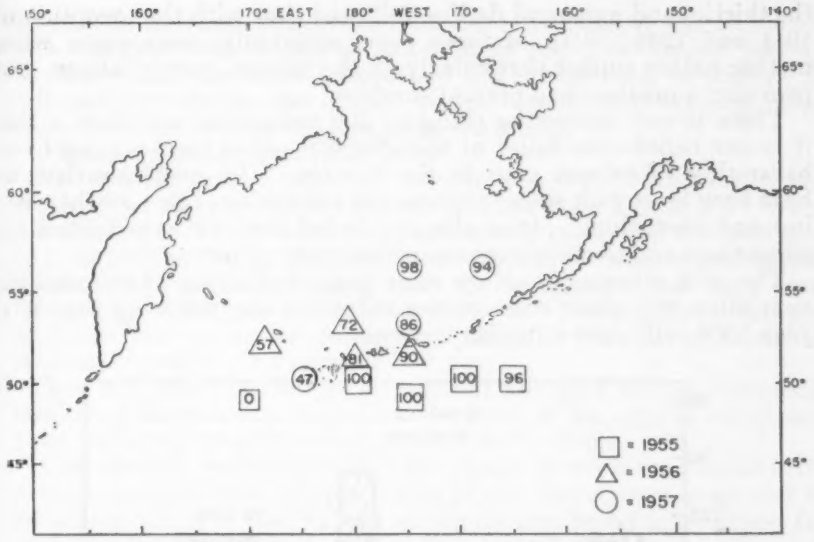
Mr. Allen. Is it not also true that the conferences and meetings being held currently should discuss this matter and it is rather urgent that we get our scientific facts on that tagging carried on at a greater rate than might otherwise be the case?

Mr. McKernan. Yes, sir; that is absolutely correct. I have a few slides on the results of those major research programs, too.

Mr. Tollefson. Could we see the last slide again, please?

Mr. McKernan. Of the value?

Mr. Tollefson. Yes.



Distribution of North America red salmon in percent based on analysis of individual fish.

Mr. McKernan. The North Pacific sea salmon research has been carried on in using five major techniques. This is the research being carried on to ascertain the distribution of American salmon on the high seas. These particular lines of research include tagging on the high seas and this tagging that the chairman mentions—requested information on a few minutes ago—has provided considerable information. We have been studying means for identifying and enumerating parasites that are specific to salmon of American origin and those that are specific with respect to Asiatic origin.

Mr. Tollefson. What I want to inquire about is this: I think that you said in 1956 the take of salmon was up to about 4 million cases; is that correct?

Mr. McKernan. Yes.

Mr. Tollefson. It does not seem to match up with the 4 million mark on that chart.

Mr. McKernan. Excuse me. I am sorry. I appreciate your calling that to my attention. Three million cases would have been correct.

Mr. Tollefson. I want the record to show the correct figure. I understand that we have not had a catch of 4 million in several years.

Mr. McKernan. That is correct, and I am very sorry for that error. I believe I was thinking of the total American pack rather than the Alaskan pack.

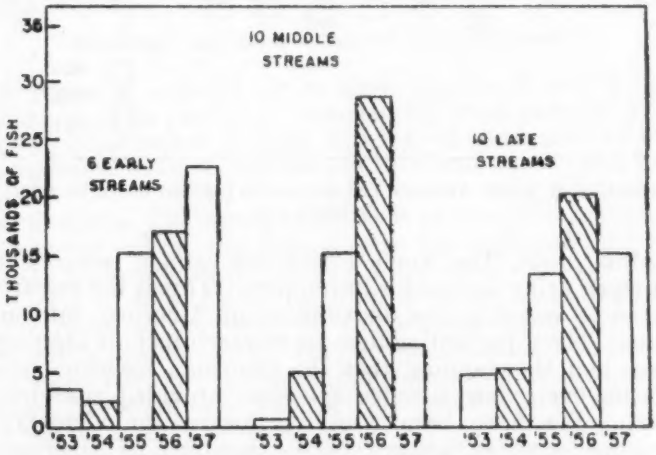
Mr. Tollefson. That is all.

Mr. McKernan. This shows the cyclic appearance. That is, the different cycles of pink salmon that I mentioned to you a few minutes ago and which indicates the general trend. There is the even year cycle. The parents of 1925 produced the young of 1927, 1929, and so forth. You can see that a general peak of production occurred in

the thirties and a general decline followed that with the exception of 1941 and 1949. Both of those years apparently were years when mother nature smiled particularly on the salmon, young salmon, and provided a greater than normal survival.

There is one interesting thing in that connection and that is that it is our belief—the belief of the scientists—that there was an overharvesting of salmon runs in the thirties. The problems that we have been beset with since that time are reflections of this overharvesting and overfishing. It is also our belief that we have turned the corner here and that our runs are on their way up now.

The pink salmon runs show some slight indication of this and the next slide will show some of the bases for our believing that next year, 1959, will show a further increase.



Pink salmon escapement, western district, southeast Alaska.

This is a very simplified graph showing an index of escapement; that is, of the amount of salmon allowed to pass through the fishery and go upstream to spawn. You will notice that I just picked out certain representative streams. There are what we call early streams, middle streams, and late streams in southeastern Alaska. For example, these areas where the environment of the salmon brings about early spawning of those runs, or earlier than in the later streams. For example, salmon destined for these early streams come into the fishery in southeastern Alaska waters early in July and proceed upstream to spawn. The late runs, on the other hand, might not come into the stream and spawn until mid-September. You can see that there is a great difference in these runs. Furthermore, they home to their natal streams, that is, the streams from which the young came. They return as unerringly as any other kind of animal that homes right to the place from which the eggs were laid. These are unique races of fish and you can, by following them from year to year, ascertain whether they are increasing or decreasing.

We have instituted some very stringent management practices in 1954 and you will see that the escapement in 1953, the average of salmon spawning per stream in these selected earlier streams, was less than

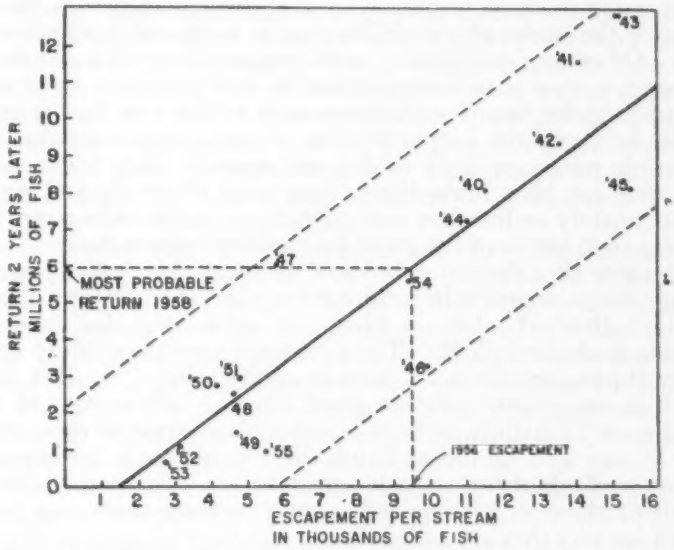
5,000. In the same streams in 1955, the next cycle, it was 15,000 and again in 1957, even though we had a rather poor run this last year due to what we believe to be a failure of the environment to provide for adequate survival because of poor natural conditions prevailing, nevertheless, we did have an increase in the spawning.

Here is the escapement [indicating].

Here in the middle streams, however, you will notice that in 1957 we dropped and the late streams we just increased a little bit. We do not think our management was particularly successful this past year but we believe that in relation to the amount of salmon that entered southeastern Alaskan waters, that the escapement was very good. That is, our management was successful. We had small runs this year and next year we are expecting an upsurge in the runs of salmon on Alaska, especially pink salmon.

You will notice in 1956 the escapement was good and our subsequent studies of downstream migration, survival of the eggs in the stream, provided us with numbers such as these, 25.7 million.

Our research work in Alaska is designed to provide the kind of information that will give us a prediction of the runs 2 years hence and the returning cycles so that we can set regulations based on scientific fact and scientific observation rather than an educated guess. Some of these particular streams are early streams like Anan Creek, and some of them are late streams like Kathian Creek, which is over by Sitka in southeastern Alaska. By some counting of these young fish we have actually estimated the total downstream migration, using standard scientific techniques. The ultimate aim is to predict what the size of the salmon runs coming back are.



Relationship of escapement to return, 70 key pink salmon streams, Prince William Sound.

These graphs look complicated but they are not really complicated. For example, in 1956 our escapement—this happens to be Prince Williams Sound—our escapement was about 9,500 fish per stream in 70 key streams in Prince Williams Sound. We found in 21 years plotted on this graph that the greater the escapement in the stream, the greater the return 2 years hence of pink salmon. You can see that this is what we call a scattered diagram and although there is variability due to natural conditions, nevertheless there is a relationship in the number of fish allowed to spawn and the number that return 2 years later. In 1956, we had an escapement of 9,500 fish and then in 1958 on the average we expect 6 million fish to return to Prince Williams Sound.

Let us see how that worked this last year. In 1955, when I mentioned that we had unfavorable natural conditions, and we think we know what those were, the winter of 1955–56 was unusually early and severe. There was not the protective snow covering on the streams in Alaska which protect the gravel and the eggs and the larvae within the gravel and so many of them, we think, died out during the winter of 1955–56.

Even so, had there been normal escapement in 1955, we would have expected 3 million fish. Our regulations this past year in Alaska were based on that particular prediction, with the natural conditions less than we expected. The returning run was actually a million or a little over. Nevertheless, it was well within the variability of our statistical method.

These dotted lines represent the variability that we can expect. In 1956 we expect on the average of 6 million fish back but this might vary between 9 million and about 2½ million. As we get more information, more scientific evidence on this particular species, we expect to narrow the limits of variability and to make our predictions much better. Of course, practically speaking, and from the standpoint of the industry, this is most important because they can outfit in their Alaskan fisheries then for the exact size of the run that is going to come in, bring up the proper number of cans, proper number of outside people necessary both to fish and operate their canneries. All in all, they can then make their plans more efficiently and we would hope ultimately reduce the cost of salmon to the American people.

This is an example of the great Bristol Bay salmon runs.

I am sorry that these do not show up more clearly but you can see the migrating sockeye salmon along the edge of the river. These are actually individual salmon. There are some there that have gotten over onto a shallow shelf. These migrate up during July of every year by the thousands and hundreds of thousands. In fact, in 1956, we had an escapement into the great isle and lake system of Bristol Bay of over 12 million sockeyes, perhaps the greatest escapement in recent history and we like to think these were due to improved management methods using scientific evidence accumulated. This is an example of these sockeye or red salmon on their spawning grounds. You can see why they are called that.

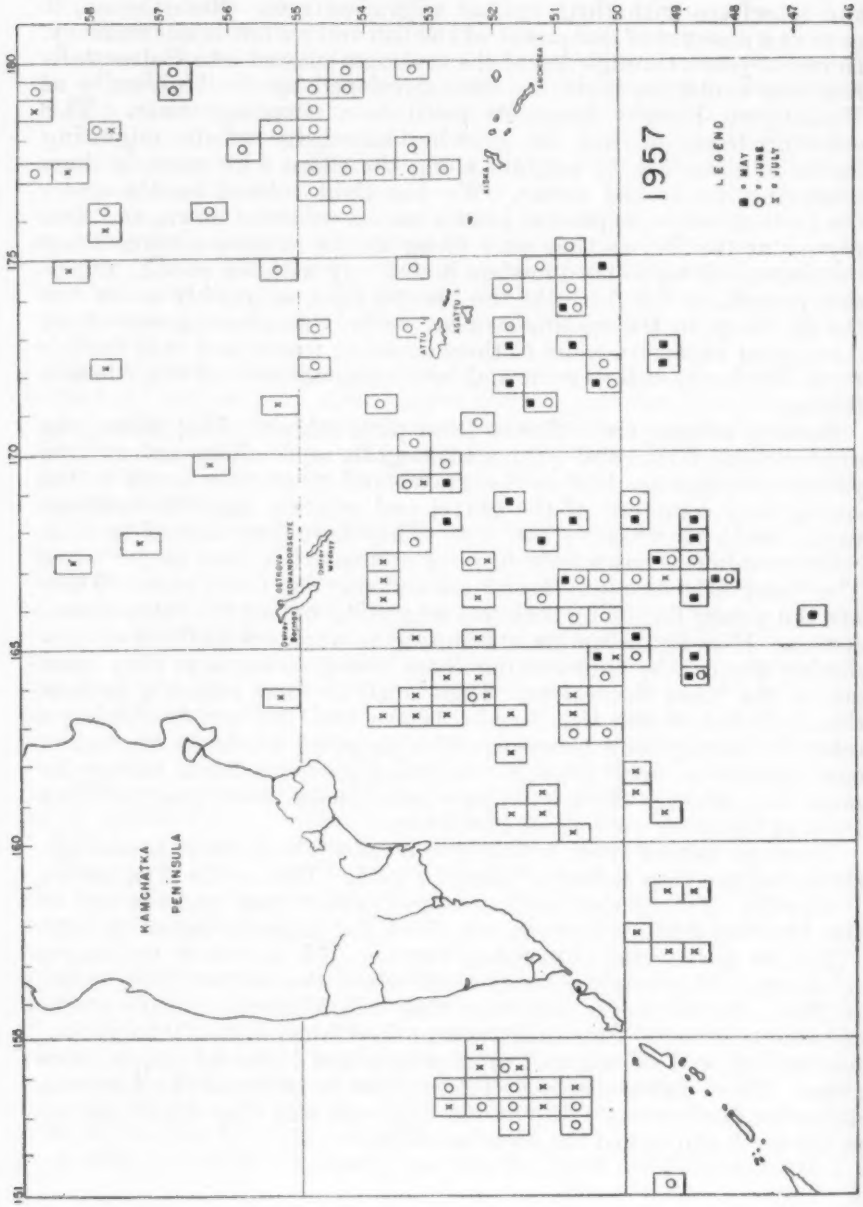
As they get closer to spawning, they get more brightly colored.

In past years we have counted the fish as they proceeded up these rivers in Bistol Bay. We put in these rather costly and expensive weirs and counters that the fish passed. We have known for some time that this might damage some of the fish because it blocks them and interferes with their normal migration rate. Nevertheless, it gave us a measure of escapment of the fish and we felt it was necssary. In recent years, through one of the contracts entered into, Saltonstall-Kennedy contracts, there has been developed by the University of Washington Fishery Research Institute a counting tower. This counting tower utilizes our growing knowledge of the migrating habits of these fish to migrate along the shore with none of them migrating out in the center. We put light colored panels across the bottom, very inexpensive plastic panels weighted down, and simply count the fish as they pass along in the stream, coming along the shore, and we do not interfere in any way with the normal migration pattern of the fish. At the present time, as quickly as we test the efficiency in the specific stream, we are transferring over from these great expensive weirs to these counting towers and thus freeing funds for better enforcement and better management of the Alaskan fishing.

Sockeye salmon are different from pink salmon. Pink salmon in southeastern Alaska and other areas migrate up small streams and the young fish eggs are laid in the gravel and when they hatch in the spring they come out of the gravel and migrate right downstream to the ocean as what we call fry. They have just started to feed. Sockeye salmon spawn only in river systems that have major lakes. The young fish come into these lakes and stay for 1 to 3 years. These are the young fingerling sockeyes migrating out of the lakes downstream. Here again we are attempting to work out methods of predicting the run by enumerating these young sockeyes as they come out of the lakes themselves. That is all to some extent a prelude that indicates to you that within Alaska itself we are developing a scientific management program and a program where we are basing our regulations upon scientific data and scientific facts, but at the same time offshore there have been some major developments which I would like to review for you a little bit.

These particular spots in this graph show where the Japanese offshore mother ship fisheries fished in 1955. This is the Kamchatka Peninsula. This is the Southwestern Pacific Ocean and the end of the Aleutian chain. You can see where the Japanese fished in 1955.

Earlier in the year they fished further offshore but as the season progresses these brighter spots show where the mother ships fished in May. As the season progresses they will follow the Asiatic stocks of salmon inshore. Late in the season they fished in the Okhotsk Sea, fishing both red salmon and pink salmon and chum salmon in those areas. There was a change in the fisheries in 1956 and the Japanese did some further exploring on the high seas and they found fish up to the north and east of the Aleutian chain.



1957 Japanese High Seas Salmon Fishing Area

In 1957, they sent about half of their mother ship fleets north and east of where they had fished in 1955 and they caught large amounts of salmon in May in this particular area right up here [indicating].

The tentative abstention line that we spoke about a little while ago is over about here [indicating]. This is 180°, the international dateline, and to this side 175° west longitude is right along here [indicating]. This is 175 east longitude, 170 and 160. They sent their mother ships then in 1957 both north and east.

We have a slide showing that they took considerable quantities of salmon destined for American streams. In fact, in one 10-day period they took approximately between 5 and 10 million fish in this particular area [indicating].

This shows the abstention line at 175° west longitude and this shows that in this approximate fishing area from June 11 to 20, when they took from 5 to 10 million salmon, probably most of those were destined for American streams. One of our problems here is that the Japanese are fishing 7 days a week, have tremendous long gill nets out here with any number of boats and any sized boats, and any sized fleet they want, but at the same time we are regulating stringently our own fishermen here in the Bristol Bay area. In fact last year when the runs failed to materialize because they had been taken offshore, we believed, when they failed to materialize in the numbers and quantities that we felt they would on the basis of our predictions, we had to restrict our fishermen even more. At one time during this very short season our own fishermen were being allowed to fish only one day a week. That was in the face of the fact that all of their equipment, all of their cannery crews, fishermen, and tremendous investment had been brought up from the States to gear these canneries for high speed and high level production during the month of June 25 to July 25. During this period of time, during the height of the season, we had to restrict the fisheries in order to achieve a conservation of the sockeye. We had to restrict the fishing to as little as one day a week.

Mr. TOLLEFSON. Mr. McKernan, you have not said anything about whether or not our American fishermen can fish out on the high seas.

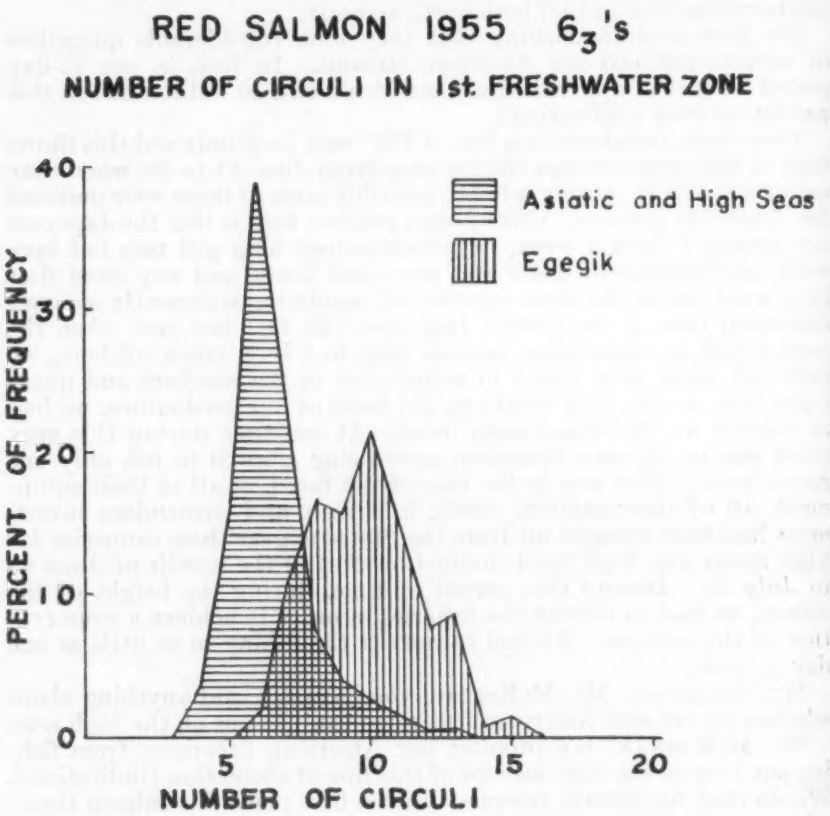
Mr. MCKERNAN. We prohibit our American fishermen from fishing out here on the high sea east of this line of abstention [indicating]. We do that for several reasons. In the first place, the salmon themselves are immature when they are out here [indicating]. They get very rapid and very fast growth during the last year of their life and so we believe, although we cannot entirely prove this, that it would be a waste to catch them on the high seas out here [indicating].

Secondly, we cannot manage the fisheries as well when they are taken out here because we do not know where these salmon runs are destined. That is, we cannot tell the specific streams that they are destined for and set the season and allow a proportional harvest when they are fished on the high seas. We require our fishermen to abstain, and this is especially true during these years. I believe the facts show it is necessary to rehabilitate these important salmon runs.

I mentioned the general areas of research that were carried on, such as tagging, and we are also attempting to study the markings on the salmon scales. We hope by these means to identify fish that have been raised in American streams as compared to those raised in the

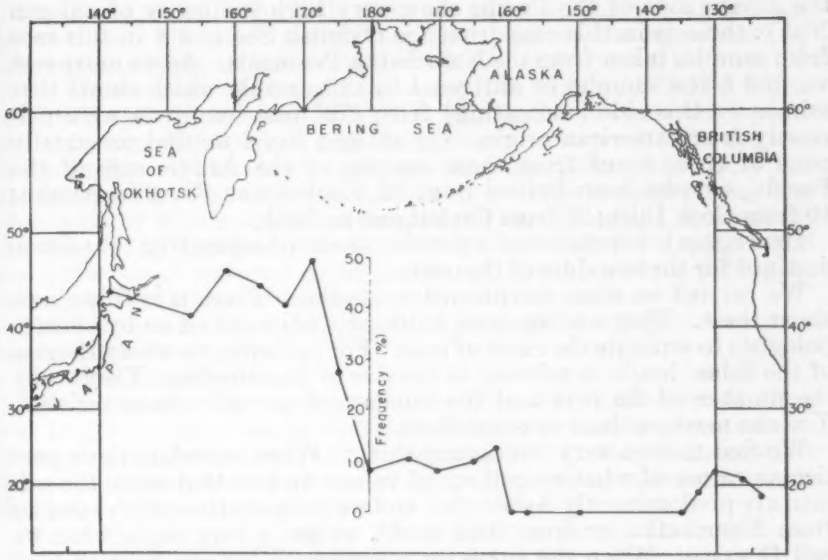
Asiatic streams. We have had considerable success and in fact far more success than we had any right to expect in such a short period of time.

This great program in the North Pacific is engaged in not only by our own scientists but by Canadians and Japanese. It is truly a great oceanwide experiment in the identification of salmon and their origin.



You will notice this red salmon from the Ikpikpuk River which is one of the important rivers in Bristol Bay, you will notice a certain number of growth rings. We call them circulae.

On the right of this slide is shown the inside of this whole salmon scale, and this is blown up and expanded. We have counted and we find that there are twelve circulae before we get what we call an annual check and then twelve more circulae. Then there is a certain frequency of growth ring development in the salt water growth of the scale. You will remember those when we looked at the fishing from the Okhotsk Sea. You will notice here that in the fresh water where we have had 12 on the Egtgik River slide, here we have 7 and 10. It is quite a different picture in the scale from the Okhotsk Sea. The same differences apply in the saltwater growth. Thus we are able to pick up a salmon in the high seas and by taking the scales be quite confident that this salmon has originated either in American streams or Asiatic streams. That is not the only thing.



INCIDENCE OF ANISAKIS INFECTION
(Intensity ≤ 25)

I mentioned that we were also identifying and enumerating the parasites that were associated with fish.

By the way, I hasten to add that these have no effect on either the quality or the edibility of these particular species, they being rather harmless, small parasites that are associated with parts of the fish not eaten. It is an interesting thing to notice that the frequency of these parasites from samples of fish taken over here in this particular area of the Western Pacific [indicating] had a very high frequency of this particular parasite called anisakis. About 40 to 50 percent of all of the samples of salmon taken had a certain intensity of infection of this particular parasite, whereas in this particular area [indicating] between 170° east longitude and 180°, international dateline, there was a radical change in the samples, and east of that line and clear over to samples taken right in our own streams themselves, the incidence of infection was very, very low.

What can we conclude from this? We can conclude there is an area of intermixing of Asiatic and American salmon within the area of 170° east longitude and 180°, but the Japanese now by this provisional line can fish clear over to here [indicating].

In other words, the Japanese, based on this particular evidence, can fish predominantly on American stocks of salmon without in any sense abrogating the American agreements made at the time the treaty was written.

We have carried on some research on some other particular lines. That is, the testing of salmon blood serum and the serological reactions of the blood. We find what the scientists call antigens which show themselves to be present in specific races of fish. All of these figures are not too close; I will indicate to you that the stocks of fish from

the Asiatic side of the Pacific show very high frequency of antigen No. 1: three is in this case from the Okhotsk Sea and 4 in this case from samples taken from the Kamchatka Peninsula. As we move east we find a few samples of antigen 1 in this sample which shows that salmon on this side [indicating] from 172° east longitude were primarily from American origin. On antigen No. 2 we find practically none of them occur from these samples of the Asiatic side of the Pacific, samples from Bristol Bay; 72, Kuskokwim River in Alaska; 10 from Cook Inlet; 27 from Carlett and so forth.

Here again is a specific and a positive means of separating the salmon destined for the two sides of the ocean.

We carried on some morphometric studies. There is nothing new about these. They are the same kinds of studies caried on by anthropologists to separate the races of man. For example, the study the size of the fishes' heads in relation to the size of their bodies. They study the number of fin rays and the number of meristic characteristics. You can measure those or count them.

We find there a very interesting thing. When we relate these particular values of what we call racial values we find that when the salmon are predominantly Asiatic fish and we compare them with samples from Kamchatka, or from Asia itself, we get a very high, what we call D value. When the curve is as high as it is here, west of 170° east longitude in this area that I am pointing to [indicating] we find that the fish show a very high relationship in their characters with those from the Okhotsk Sea and from the eastern side of the Kamchatka Peninsula.

On the other hand, when we compare these same high sea samples with the measurements of typical Alaska, Pacific salmon, we get very low values showing that these fish are more akin to fish from the Asiatic side. When we take samples in the area from 170° east of this area [indicating] we get then very high values when we compare them with salmon from the eastern side of the Pacific and very low values when we compare them with the Asiatic stocks.

What we conclude from this is that around 172° east longitude there is just about perfect mixing of the stocks of salmon from American and Asiatic origin.

You will remember that our provisional abstention line is over here at 175° west longitude. I should also remind you that the study that I have been showing, the example here, is of the red salmon. That is the sockeye salmon which is found in Bristol Bay and other important waters.

Mr. TOLLEFSON. A moment ago you said that Japanese could fish west of the permitted line and take our Alaskan-reared salmon without violating the agreement. That, as I understand the agreement, is not completely true. Was it not the basis for the treaty understanding that they would abstain from catching or taking our salmon?

Mr. MCKERNAN. Mr. Tollefson, this came up at the recent North Pacific meeting in Vancouver, that I am sure you are familiar with, and the provisions of the treaty state that in setting up this line it was the wish of both governments to provide a line which would bring about the abstention by the Japanese from stocks of fish of North American origin, but in the treaty the Japanese agreed only to abstain from fishing east of 175° west longitude.

Mr. TOLLEFSON. Technically they are not violating any agreement, but are they not in fact violating the spirit of the agreement by catching our salmon wherever they catch them?

Mr. MCKERNAN. One might interpret it in that way, but of course until this year, in fact, and until this fall, there were only the 3 years of field research behind us and we were not in a position to set any closer limits. When they fished out there in 1957, neither they nor we had any idea that they might be catching large or major quantities of salmon of North American origin. In all fairness, I must admit that insofar as had been proven until this late fall, the Japanese did not know, or at least we could not prove, that they were fishing on salmon of North American origin.

Mr. TOLLEFSON. Does the agreement provide for renegotiation as to where the line should be?

Mr. MCKERNAN. Yes.

Mr. TOLLEFSON. In other words, the basis for that understanding was that experience might show that they were catching our salmon even up to the present line, and they agreed in the treaty to renegotiate for a line, if it developed that they were catching our salmon. Is that not roughly true?

Mr. MCKERNAN. Yes, there are provisions in the treaty for renegotiation of the line itself and steps have been taken through the Commission to start that particular action.

Mr. TOLLEFSON. They had a meeting in November, did they not?

Mr. MCKERNAN. Yes.

Mr. TOLLEFSON. The Japanese and the American and Canadian members were there?

Mr. MCKERNAN. Yes.

Mr. TOLLEFSON. Was this particular subject discussed at that meeting, do you know?

Mr. MCKERNAN. Yes.

Mr. TOLLEFSON. What was the Japenese reaction to it?

Mr. MCKERNAN. The Japanese felt that the evidence was not preponderant enough for them to act hastily and yet they were willing to set up a committee to look into this particular problem starting at the next meeting, which is in November of next year.

Mr. TOLLEFSON. In other words, they will have another fishing season behind them before there is another Commission meeting?

Mr. MCKERNAN. Yes. Excuse me, unless a special meeting might happen to be called.

Mr. TOLLEFSON. The Chairman of the Commission presently is a Japanese is he not? Is not the present Chairman a Japanese?

Mr. MCKERNAN. Yes, the new Chairman, I believe, is a Japanese.

Mr. TOLLEFSON. There will not be much likelihood he will call a meeting before next November?

Mr. MCKERNAN. If my memory serves me correctly, any one of the participating nations can request a meeting. I believe it has to be agreed upon by all three member nations.

Mr. TOLLEFSON. Can you tell us what support, if any, we have gotten from the Canadian representatives?

Mr. MCKERNAN. The Canadian scientific evidence is paralleling our own very carefully in the lines of research in that they are carrying something on in this area. In fact, the parasite studies by the

Canadians were most outstanding and very excellent work. In fact, all of their research has been very good, but nevertheless they tended to believe that perhaps we should proceed rather slowly. It is not clear at the present time that their stocks of fish are involved to the same degree ours are.

Mr. TOLLEFSON. Are you personally convinced that they are catching our salmon?

Mr. MCKERNAN. Yes.

Mr. TOLLEFSON. What about the rest of the people on our Commission? Are they convinced, too?

Mr. MCKERNAN. We are all convinced. This scientific evidence is, in my opinion, irrefutable and no one can refute it.

Mr. TOLLEFSON. Then do you know how many fish the Japanese caught in this general area that we have been speaking about, this past fishing season, this last year?

Mr. MCKERNAN. Probably about 10 million.

Mr. TOLLEFSON. You are talking only about the red salmon?

Mr. MCKERNAN. Yes; remember that our fish migrated south of the Aleutians also. It is very likely that in this area the Japanese fleet took our fish in concentrations. It is very likely our fish were beginning to school for their homeward migration to the American streams, but the Japanese have been fishing for a couple of years on immature sockeye salmon in this area, too, so they have been fishing not only on the mature salmon, the red salmon that were migrating back to Bristol Bay, but they probably took the salmon both in this area [indicating] and to the south of the Aleutians last year, and perhaps the year before.

Mr. TOLLEFSON. How long have the Japanese been fishing in this area?

Mr. MCKERNAN. The Japanese started fishing in 1952, and in that time they tended to fish pretty much down in the area I am indicating, probably between 160° and 170°, and probably very little north of the Aleutian Islands into the Bering Sea.

They took relatively small numbers. I believe the first year it was 11 million fish, and they have increased their take in the high seas, and I believe in 1956 they took some 50 million and in 1957, sixty-some million fish.

Mr. TOLLEFSON. I remember receiving, or seeing, some figures to the effect that in 1951 or 1952 they caught about 2½ million fish and in 1956 they jumped up to about 60 million.

Mr. MCKERNAN. Yes, those are approximate figures.

Mr. TOLLEFSON. Now in 1956 and 1957 our own catch by our own fishermen was down, was it not?

Mr. MCKERNAN. Yes.

Mr. TOLLEFSON. Could our own low catch in those years be related to the increased take by the Japanese?

Mr. MCKERNAN. In 1957 I believe that the moderate take in Bristol Bay and the moderate size of the run in Bristol Bay was brought about because of the Japanese taking of several millions of fish of Bristol Bay origin offshore. We expected a much bigger run in Bristol Bay than actually came in and all evidence of the timing of the run, and every other feature of the run, indicated a fairly good-sized run but yet the fishing peaked sharply and fell off very rapidly. At the

same time we began to get fish in Bristol Bay which had what appeared to be Japanese net marks on them. They were marks of nets of very much smaller size than we use. They actually catch the fish when they are smaller and immature salmon, before they grow big.

Mr. TOLLEFSON. In the last 2 or 3 years has the importation of canned Japanese salmon increased?

Mr. MCKERNAN. Yes, very decidedly.

Mr. TOLLEFSON. I think on Friday you mentioned some figures. Do you recall them now?

Mr. MCKERNAN. I believe that the Japanese importation last year was somewhere around 500,000 cases, or so, and it was my understanding that they had pretty close to a million cases ready to export to the United States this year.

Mr. TOLLEFSON. That is a terrific increase over earlier importations of canned Japanese salmon?

Mr. MCKERNAN. Very decidedly so, a very rapid increase.

Mr. TOLLEFSON. That is all, Mr. Chairman.

Mr. LENNON. You mentioned a few minutes ago that the fish in schools presently who intended to migrate downstream showed an evidence of Japanese net marks, which was a much smaller mesh. Was the Department instrumental or helpful in getting them treaties for the same size of mesh Japanese fishermen and our fishermen use?

Mr. MCKERNAN. This has been proposed but the problem is that the Japanese theoretically have abstained from fishing American salmon. The results of our research are such that we are only now finding that they are catching American salmon. Secondly, if, for example, we are to propose a different mesh size for the Japanese they might request that we do away with the absention line.

Mr. LENNON. Very much like our textbook situation. They make the grammar rules and we have to follow them?

Mr. MCKERNAN. Not particularly. There is another feature which I would like to mention here. There is some basis for allowing them to use smaller mesh nets in that some of the races of fish on the Asiatic side are smaller than ours and you need smaller sized nets to take these fish. Generally speaking, they have the smaller sized fleet to take immature fish.

Mr. CURTIN. Mr. Witness, are some of these fish spawned in Russian waters?

Mr. MCKERNAN. Yes.

Mr. CURTIN. Do we have any question of the Russians fishing on the high seas, like the Japanese?

Mr. MCKERNAN. Up to the present time they have not fished offshore like the Japanese. Remember that in a sense they do not need to harvest their own on the high seas if they have free access to them, because they take them efficiently and economically when they enter their streams.

Mr. CURTIN. They pose no problem like the Japanese do in taking our fish?

Mr. MCKERNAN. No, not at the present time. The Russians and the Japanese were locked in negotiations this last winter because the Russians claimed that all of these salmon in here were destined for Russian streams so they set up a quota of their own and they limited the Japanese take by the quota. The Russian and Japanese question

is quite different from ours. Before the war the Japanese fished almost entirely themselves the stocks of salmon all along this particular area [indicating], and the Russians did very little fishing of the Asiatic stocks of salmon. The Japanese never fish our stocks of salmon, and all they did was a little bit of exploratory work in here perhaps the last year or two before the war. They had no high seas fishing on high seas stocks of salmon. They fished off the coast a little bit, but most of their ships and factories were shore-based on the Kamchatka Peninsula and the Kuriles Islands. They have some historic rights to Russian fish where they have no such rights to stocks of American origin. This is one of the important differences in our position with respect to the Japanese and the Russians' position.

Mr. TOLLEFSON. The Russians, I understand, have seized a number of Japanese fishing boats in recent years.

Mr. MCKERNAN. Yes.

Mr. TOLLEFSON. Do you know where they were seized, high seas or where?

Mr. MCKERNAN. They were seized outside of 3 miles, if you want to call that the high seas. I think some of their boats were seized in the Okhotsk Sea in through here. In fact, I do not know.

Mr. CURTIN. That is all I have.

Mr. MCKERNAN. I do not know of any seizure offshore, off the east coast of Kamchatka, but there may have been.

Mr. TOLLEFSON. Do you know whether they were seized because they were taking stocks of Russian fish, or because they were within so many miles offshore?

Mr. MCKERNAN. I am not sure what charges the Russians placed against these boats, Mr. Tollefson.

Mr. TOLLEFSON. That is all.

Mr. MAILLIARD. If the Japanese were to step up their fishing right up to that line presently agreed upon, they could very nearly destroy our red salmon, could they not?

Mr. MCKERNAN. Yes, they could.

There is another feature here and that is that even some of the salmon on this side of the line, on the east side of the line, during their migration, migrate probably freely in search of food on the high seas. Let us say at any one time there is only 10 percent of the salmon of American origin on this side of the line, during the time of 3 years on the high seas, but it is undoubtedly a different 10 percent. With even 10 percent there in that way with intensive fishing the Japanese could deplete completely our salmon runs and negate the very intensive rehabilitation program that both the industry and fishermen have rather willingly participated in with the Federal Government.

Mr. MAILLIARD. Would it be fair to say that unless we are able to renegotiate that line considerably westward, our only alternative would be to go out there and fish, too?

Mr. MCKERNAN. In that way simply write off our own stocks of salmon?

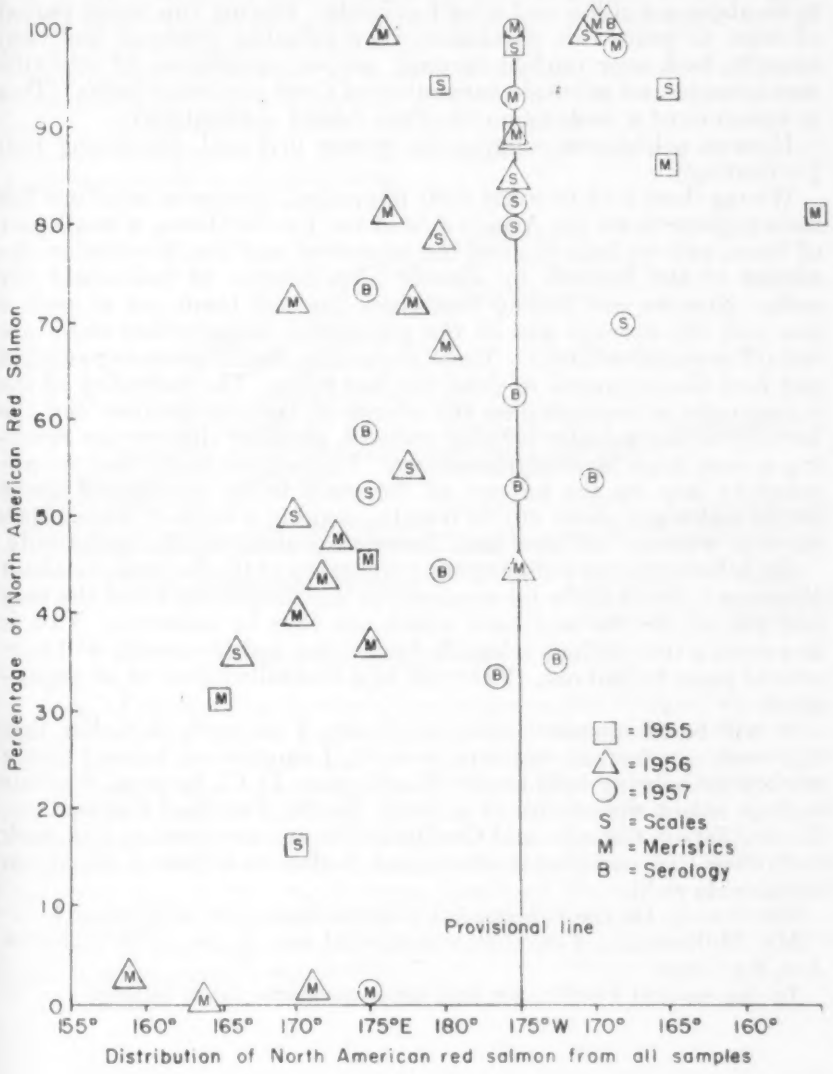
That is not a very good alternative because, in a sense, we would then simply wipe out our salmon. We can do that inshore, of course, by simply taking all of the fish.

Mr. MAILLARD. Somebody is going to wipe it out and it might as well be us.

Mr. McKernan. That is certainly one way to look at it.

Mr. Gross. Mr. Chairman, it makes a lot of sense for the Japanese Government to subsidize their fishermen to destroy our supply of fish, but I wonder if the Japanese will have any objection to our raising carp in the rice paddies of Louisiana.

Mr. McKernan. This is a general summary of our findings with respect to red salmon.



This shows the chart of composite results and migration of our red salmon on the high seas where they migrate and probably where they intermingle with the Asiatic salmon.

Now, I am onto another subject, Mr. Chairman, that of fur seal responsibilities in the Pribilof Islands.

This is a village on St. Paul Island and shows part of the village which is administrated through the Department of Interior and the Bureau of Commercial Fisheries. You will remember, gentlemen, that in about 1911 there were fur seal herds on the Pribilof Islands with only about twenty or thirty thousand animals and at the present time the population of the Pribilof Islands are estimated to be about a million and a half animals. During this short period of some 48 years this particular, very valuable, resource, has been brought back over tenfold through proper application of scientific management and scientific harvesting of these particular areas. This is a picture of a rookery on St. Paul Island [indicating].

Here is a biologist tagging the young first seal, the young pup [indicating].

We tag them both to study their migration, because some of our fur seals migrate down the Asiatic side of the Pacific Ocean, a small part of them, and we have studied the migration and also population dynamics of the fisheries by specific identification of individual fur seals. Now we are finding that these fur seal herds are at such a size and the average age of the population is such that there are certain population limits. These population limits are being reached and here is an example of dead fur seal pups. The mortality of the young pups is increasing on the islands at the present time and the fertility of the females is being reduced, showing that we are reaching a very high level of abundance. In fact, we think that we are going to step up the harvest of fur seals to an average of about 60,000 males and about 30,000 females, making a total of some 90,000 harvest, whereas we have been harvesting about 65,000 males only.

We believe that by reducing the population of the fur seals by about 15 percent, it will make for a maximum sustainable yield and the very best size of the fur seal herd which can thus be achieved. This is in a sense a test of these scientific hypotheses and the results will take several years to find out. This will be a controlled kind of an experiment.

It will be of interest to you gentlemen, I am sure, to realize that this week—in fact, at this very moment, I suppose—a fur seal treaty conference is being held herein Washington, D. C., between the four nations recent signatories to a North Pacific Fur Seal Convention; Russia, Japan, Canada, and the United States are meeting this week to further the coordinated efforts and studies to achieve a maximum sustainable yield.

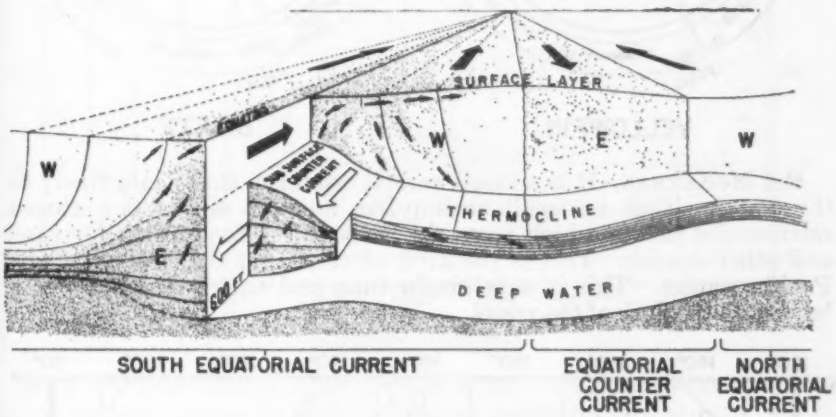
Mr. GROSS. Do the commercial fisheries have this understood?

Mr. MCKERNAN. Yes, that was spelled out in the 1956 Fisheries Act, Mr. Gross.

In the central Pacific, we had some questions on it before.

Here is another program, a tuna project in the central Pacific; the Pacific Oceanographic Fisheries Investigation. It is another special authorization of Congress and one which has been carried out since, I think, about 1950. This is a research vessel, a 128-foot tuna clipper. It was obtained surplus after the war and converted into a research vessel and has plied the central Pacific area in carrying out oceanographic and biologic information. Some of my own experience was in this area and I have spent many interesting days on this particular ship. These studies have included both oceanographic as well as biological studies on the high seas.

This happens to be a plankton net where a certain amount of water is strained and the small amount of food found in the water is collected. The amount of water collected is measured by this device in the center [indicating]. It measures quantitatively the amount of water strained by this [indicating].

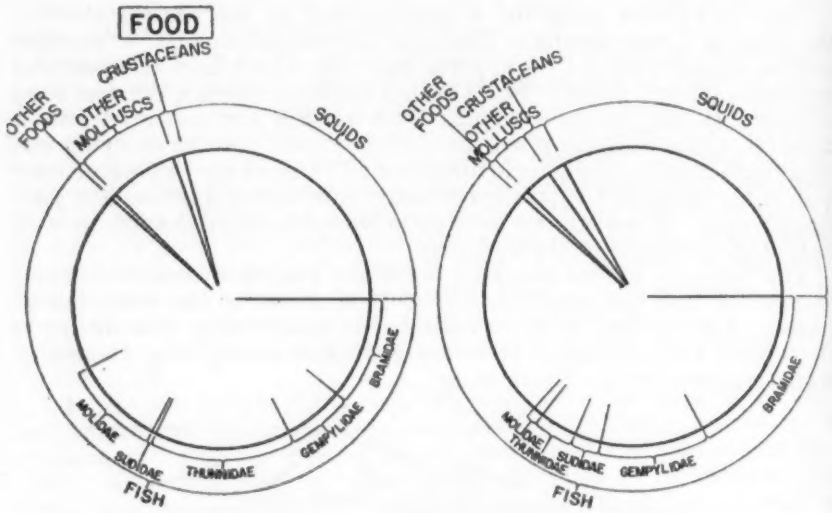


1953 concept of equatorial circulation.

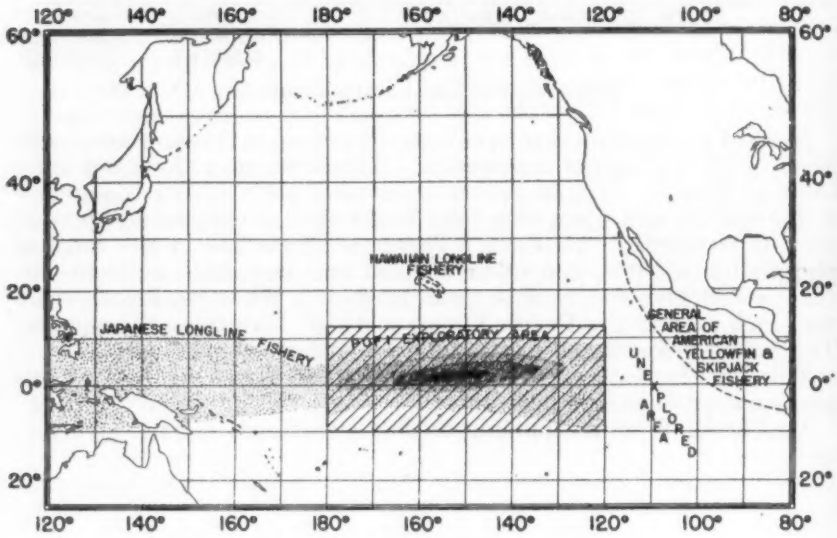
Some of the features that have been discovered in this area are shown here. This "Q" means the equator. This is about a thousand miles south of Hawaii. The deeper waters of the Pacific come to the surface at the equator and when they come to the surface they bring up what we call fertilizers with them. These fertilizers are in the form of phosphates, nitrites, and other organic and inorganic nutrient fertilizers and give rise to this chain of food. What we found was a very rich area in the Pacific Ocean south of Hawaii at the equator. The richness can be measured by the amount of zooplankton found.

This, by the way, was the laboratory that Mr. Allen visited this past summer when he was in Hawaii.

Mr. GROSS. What is zooplankton?



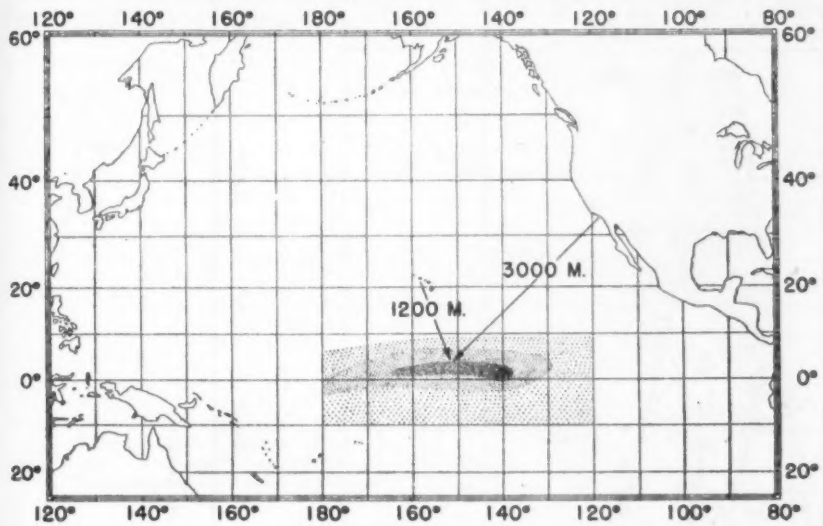
Mr. McKernan. It is a small animal organism that floats freely in the water. That is, small shrimp-like animals and others almost microscopic in size which form the basis of the food chain for tuna and other species. This is the kind of tuna that they found in the Pacific waters. This is a yellowfin tuna and that is the one being landed on the deck of the vessel.



Known transpacific distribution of yellowfin tuna.

Here is an example of the areas cross sectioned. Here is Hawaii and the Hawaiian Islands up in here [indicating]. This is a sort of a blobbed-out area under investigation with Hawaii shown in that particular spot and the American mainland and Asia over here [indicating].

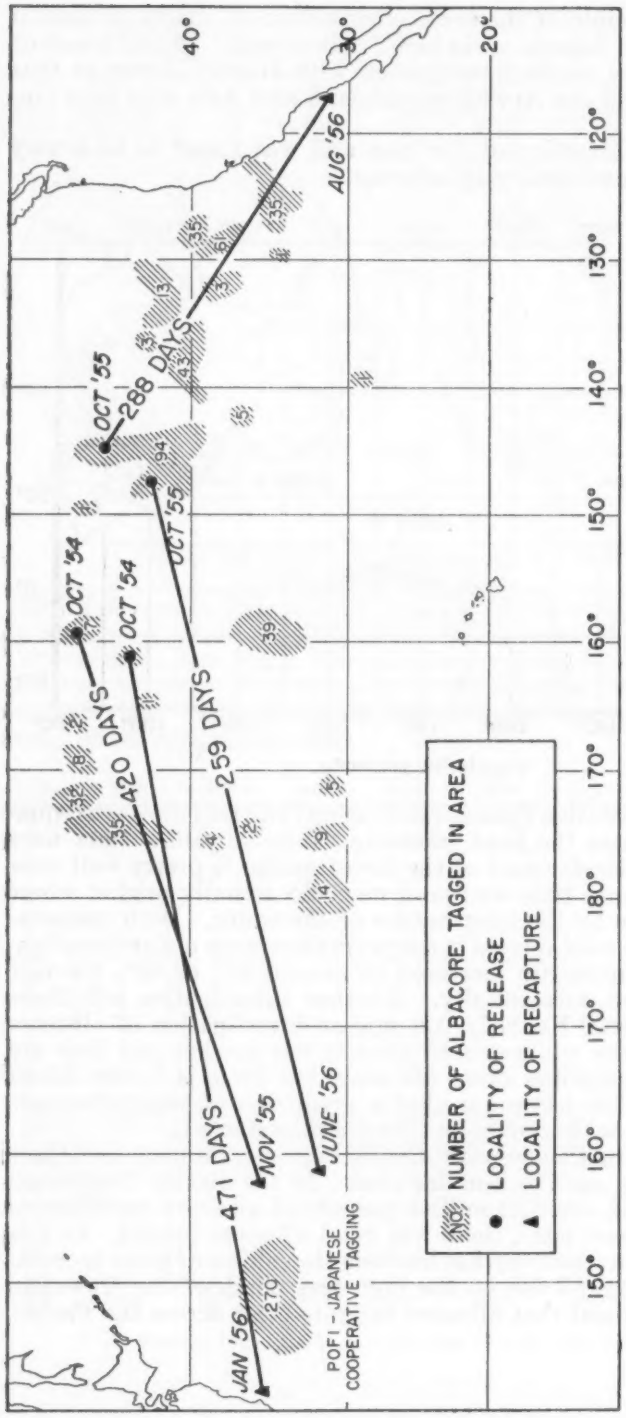
This area was investigated for tuna and was found to be a very rich source of yellowfin and skipjack tuna.



Equatorial yellowfin.

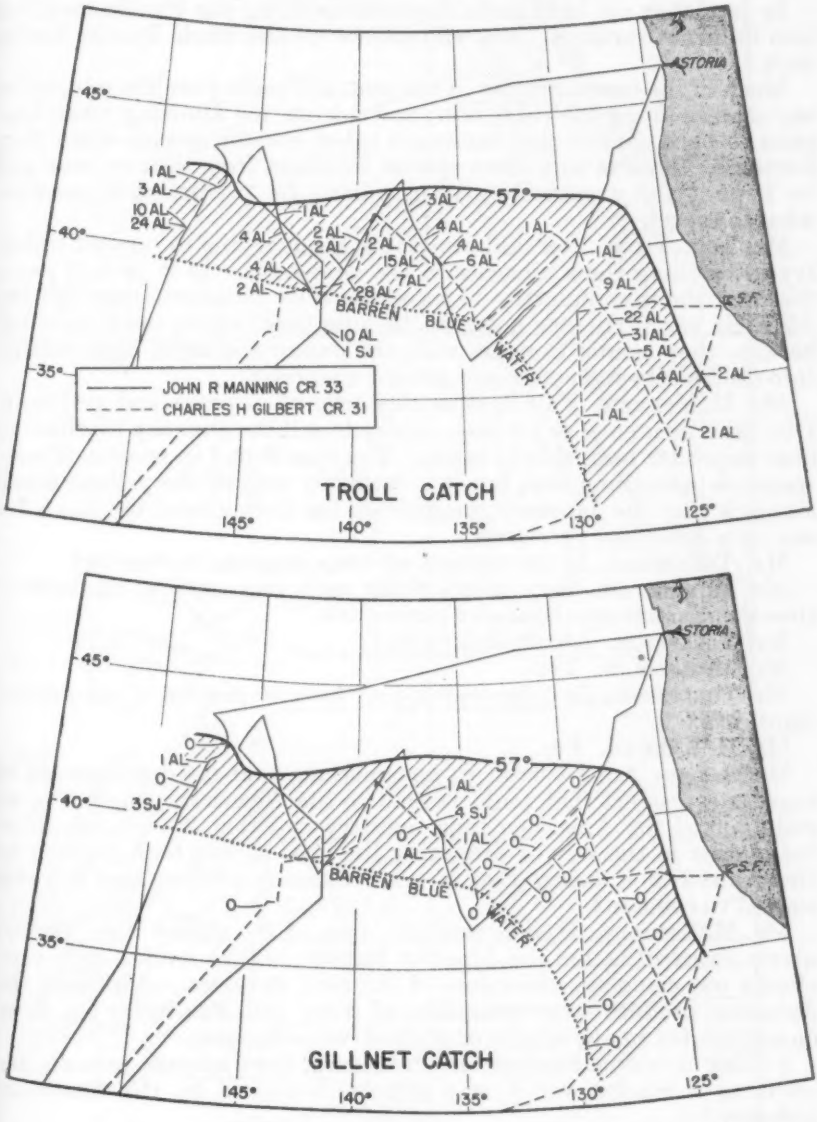
Here are the Hawaiian Islands [indicating] and this shows the equatorial regions where the most intensive bands of yellow tuna were found. That particular part of the investigation is pretty well over with, but at the same time we found we could actually predict where the tuna would be by the temperature of the water. Both temperature and fish catch were related in the years these were under investigation. As the temperature increased to around 80° or 82°, the rate of catch increased substantially. Another investigation out there under the Saltonstall-Kennedy Act was an investigation of albacore resources. It is the white-meated tuna of our market and they are taken in the summertime along the coast but little is known about their biology or life history so that a prediction of where they are found simply was not known before these studies started.

In fact, along the Pacific coast, the fish was intermittent and there was no particular good reason for that. In the Pacific Northwest, in Oregon, in 1944, some 22 million pounds of albacore were landed and yet, 2 or 3 years later, there was not 1 albacore landed. In this great fluctuation in resources that has been the subject of great speculation. We have tagged fish on the high seas north of the Hawaiian Islands and we found that albacore migrate clear across the Pacific.



Albacore tagging.

The albacore resources that the Japanese are harvesting are the same albacore that we have been harvesting on our Pacific coast. We found even more than that. We found that the reason that sometimes in Washington and Oregon, and in California, the albacore tuna are not in great abundance is simply because the oceanography, ocean currents, vary and these albacore are found farther offshore. If, in these years, vessels had gone a little bit farther, 200 or 300 miles offshore from their normal pattern of fishing, they would have found the fish off the Pacific coast.



Fall albacore surveys.

This is a diagram of the summer distribution of albacore on both the Asiatic side of the Pacific, north of the Hawaiian Islands and this side [indicating].

These investigations are almost completed at the present time and we found concentrations of albacore in the Northern Pacific and we are going to attempt to get industry to test-fish in this particular area to see if it will not be as profitable as this other.

This is the general diagram of circulation of the North Pacific and shows how the currents in the North Pacific impinge upon our coastline [indicating].

In fact, they not only make the weather along our Pacific coast but also influence sardines, tuna, and salmon of the whole Pacific Northwest.

Much of the oceanography in the central Pacific provides a basis for our studies along the coast now, and a basis for knowing what happens to both salmon and tuna and other coastal species when they fluctuate. That is why these species fluctuate from year to year and we hope it will eventually give us a basis for predicting in advance what to expect.

Mr. TOLLEFSON. You said something about trying to interest industry in catching these albacore in the new areas. Is it or is it not a fact that the tuna industry—I mean the tuna fishermen—are fighting for their very existence now, not because they cannot catch tuna but because they cannot compete with the Japanese-caught tuna coming into the country in greater and greater amounts?

Mr. MCKERNAN. This is especially true of skipjack and yellowfin. Our fishermen have as yet been unable to sell the quantity of albacore that they have been able to catch. The tuna found in more northerly waters is something else, but it is certainly true of the yellowfin and skipjack that the Japanese competition has been almost too much for our own American producers.

Mr. TOLLEFSON. Is the amount of tuna imports increasing?

Mr. MCKERNAN. Very substantially each year until at the present time the imports equal our own production.

Mr. TOLLEFSON. About 50–50 then?

Mr. MCKERNAN. Yes.

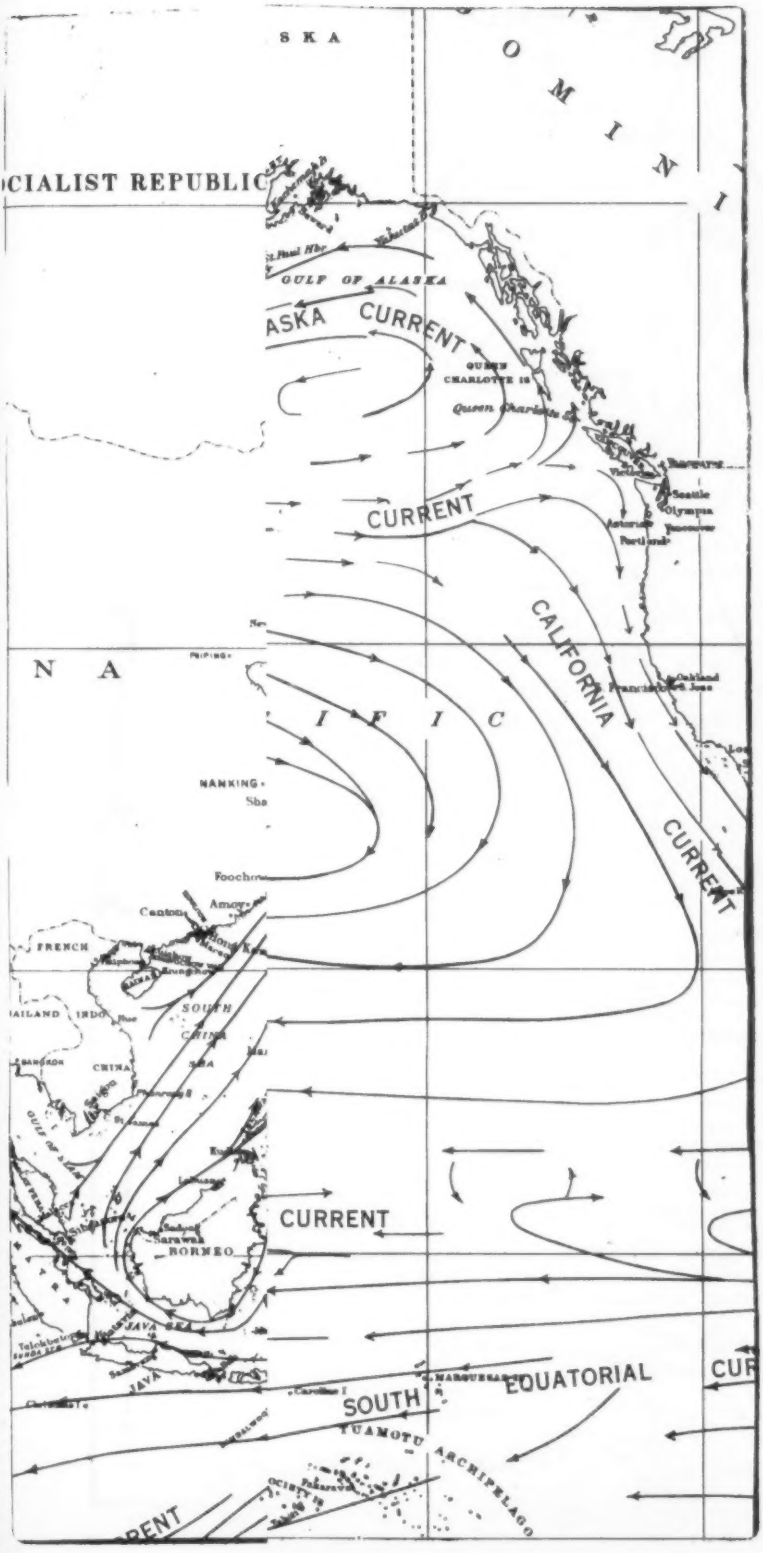
Mr. TOLLEFSON. In other words, they have 50 percent of our market right now?

Mr. MCKERNAN. Yes.

Mr. ALLEN. Am I correct in remembering that the development of tuna as a product that could be sold to the American people was an endeavor of the American tuna industry and that it was only after the market in the way of preparing the product had been reached by the American industry that it was copied elsewhere and imports started to come in?

Mr. MCKERNAN. That is correct. One of the things I am particularly aware of is that the Japanese imports of tuna tend to copy very closely our can sizes, the colors of the cans, et cetera. Although the Japanese produce large quantities of other fish, you never see those on our market in any unique or distinctive containers.

I think it can be fairly stated in general the Japanese imports are utilizing a market which was largely developed by the American industry.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CIALIST REPUBLIC
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QUEEN CHARLOTTE IS
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Olympus
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CURRENT
N A
I F I C
NANKING
Foochow
Canton
Amoy
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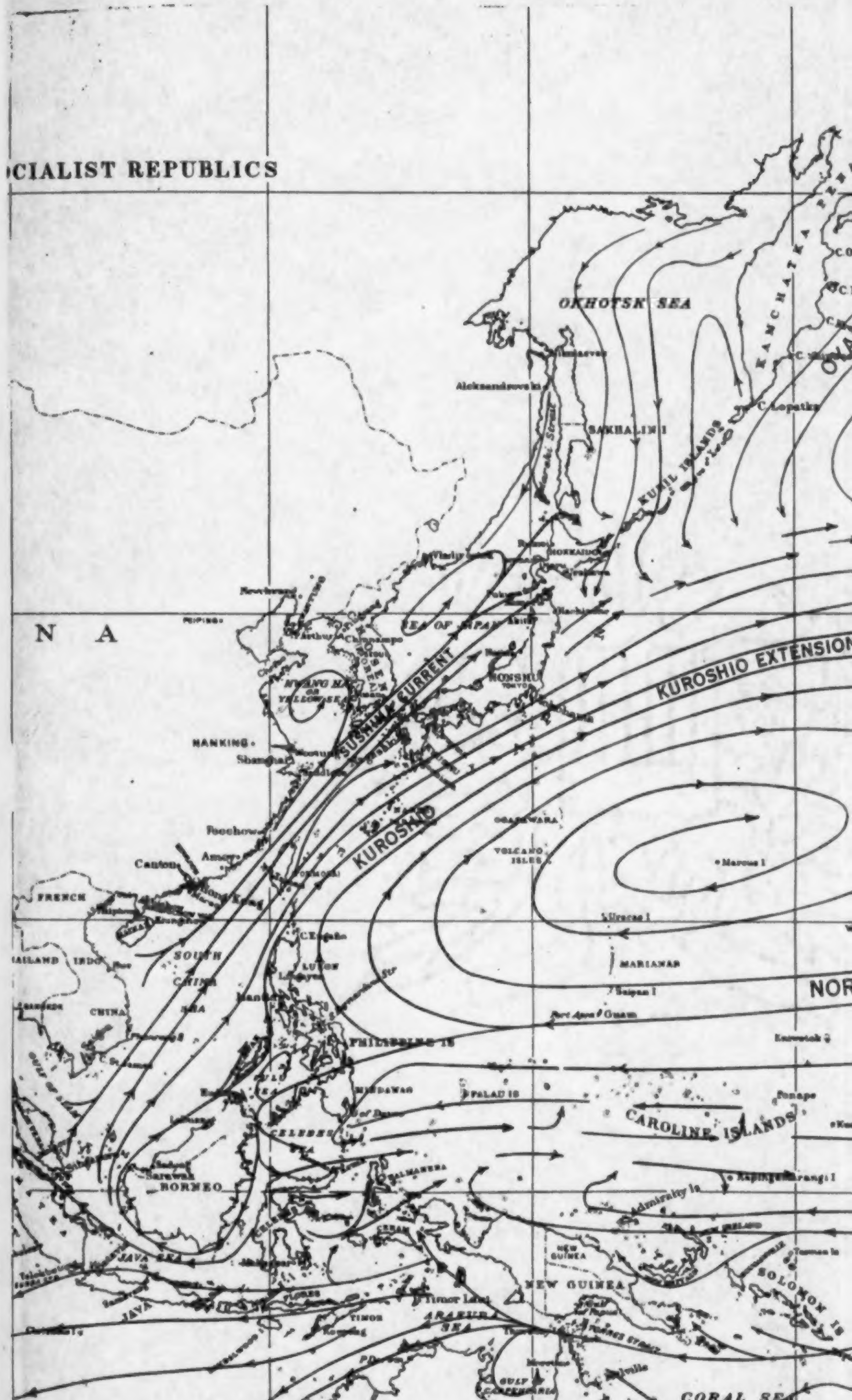

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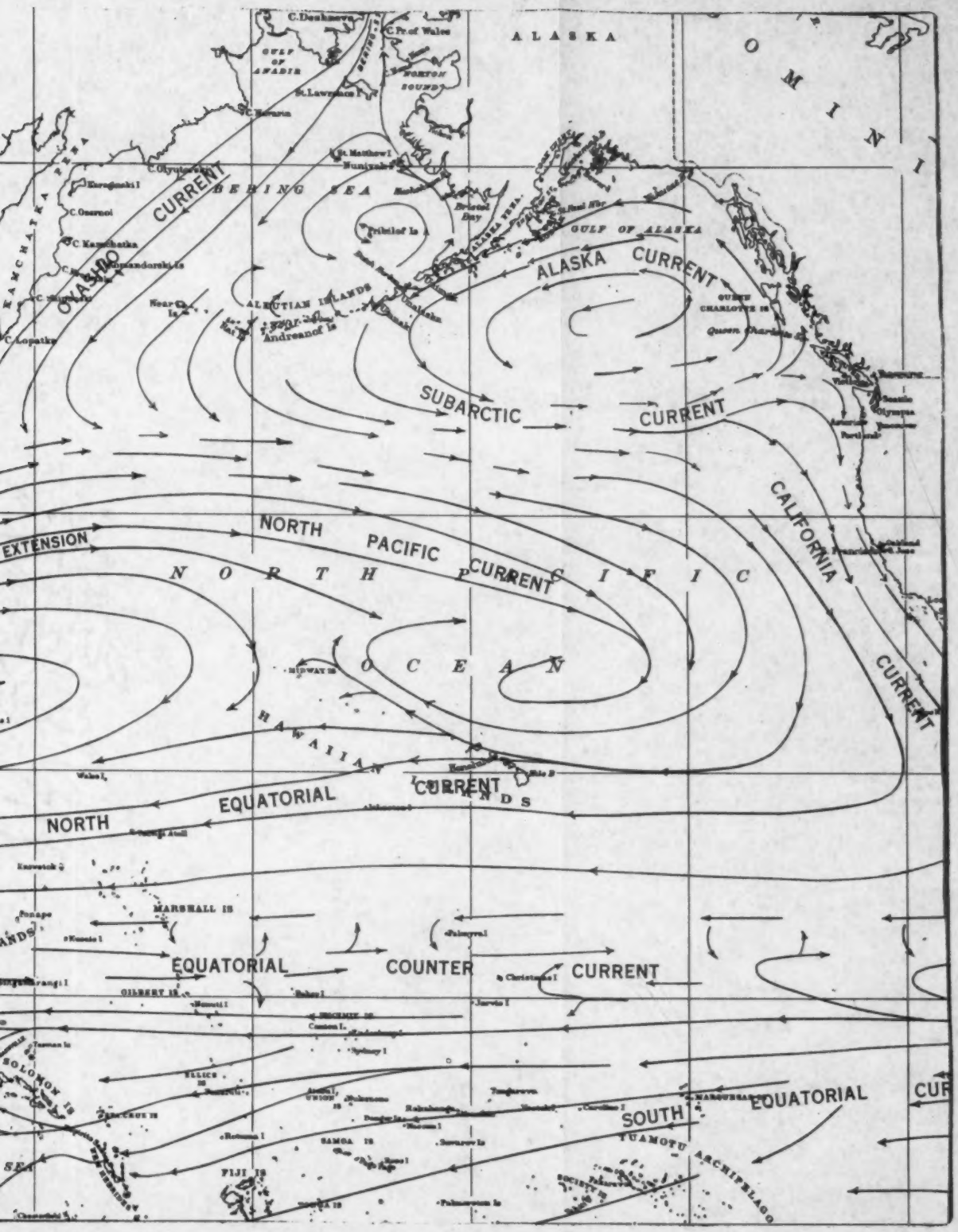
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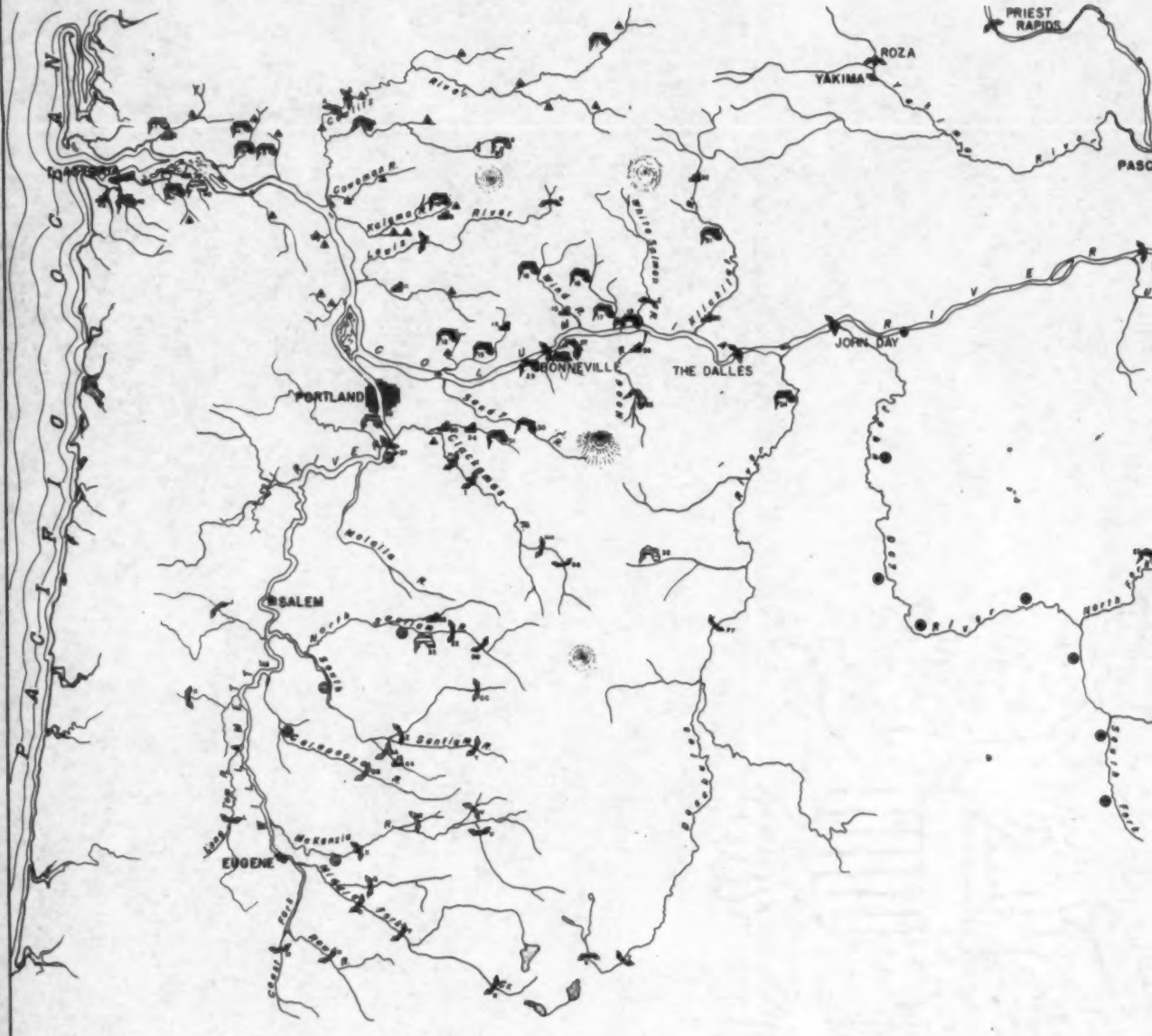
BERING SEA
OYASHIO
CURRENT
ALASKA CURRENT
GULF OF ALASKA
ALEUTIAN ISLANDS
SUBARCTIC CURRENT
NORTH PACIFIC CURRENT
EXTENSION
NORTH PACIFIC OCEAN
CALIFORNIA CURRENT
HAWAIIAN ISLANDS
NORTH EQUATORIAL CURRENT
MARSHALL IS
EQUATORIAL COUNTER CURRENT
GILBERT IS
SOLOMON IS
SOUTH EQUATORIAL
TUAMOTU ARCHIPELAGO
FIJI IS
SAMOA IS



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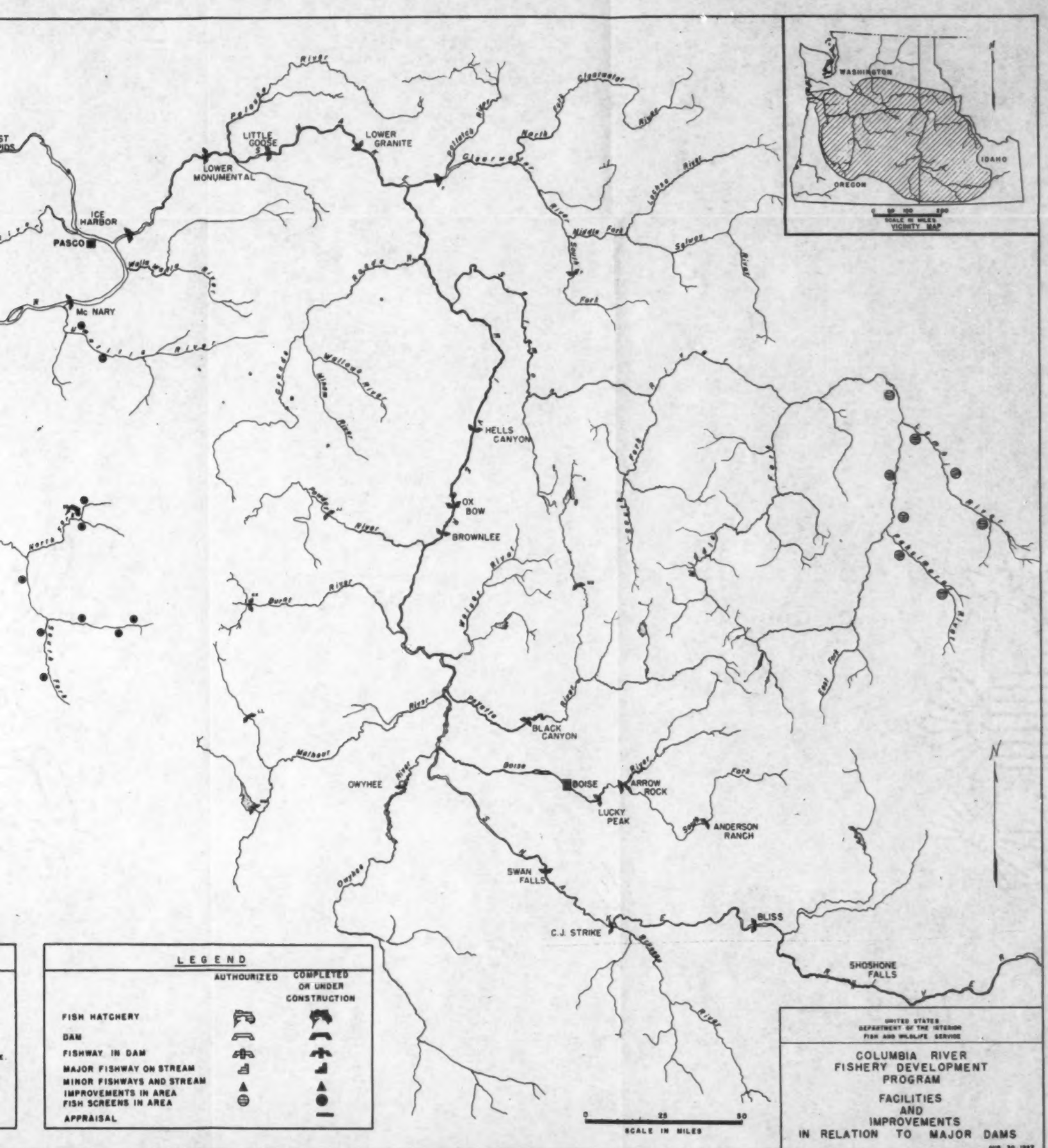
WASHINGTON
IDAHO
OREGON
SCALE IN MILES
VICINITY MAP
LITTLE GOOSE
LOWER GRANITE
LOWER MONUMENTAL
ICE HARBOR
PASCO
Mc NARY
HELLS CANYON
OX BOW
BROWNLEE
BLACK CANYON
BOISE
ARROW ROCK
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ANDERSON RANCH
SWAN FALLS
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AUTHORIZED
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FISHERY DEVELOPMENT
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IMPROVEMENTS
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AUG. 30, 1957
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Mr. GROSS. You said, I believe, that the Japanese are shipping tuna in brine to this country.

Mr. MCKERNAN. Yes.

Mr. GROSS. At a low ad valorem?

Mr. MCKERNAN. Yes.

Mr. GROSS. Is that then reprocessed in this country or is it sold in brine?

Mr. MCKERNAN. It is sold in brine. The Japanese are also sending in tuna frozen with the gills and viscera out, and those then are processed in some of our canneries and canned and put on the market in oil.

Mr. GROSS. But the tuna in brine is sold in brine?

Mr. MCKERNAN. That is correct.

Mr. GROSS. And it is not reprocessed in this country?

Mr. MCKERNAN. No, it is not.

Speaking just a little more about salmon, I would like to point out some of the progress we have made with respect to the development of means of saving salmon in these rivers where major river developments are taking place.

This is a slide of the Columbia River, the main Columbia going up in this direction, and the Snake River going here. It shows a great proportion of the Pacific Northwest, the Bonneville Dam and The Dalles, McNary, Rock Island Dam, Chief Joseph Dam, Grand Coulee, and on the Snake River is a whole series of additional dams planned, and I am sure you are aware of the difficulties that Congress has had with the plans for Hells Canyon.

This shows the amount of habitat and the productive areas of the salmon, which have been reduced by about 29 percent as the additional dams are being constructed.

In about 11 percent of the basin below McNary Dam the fisheries program will develop the salmon productivity to the very maximum to mitigate against these losses. This is the Columbia River program for which funds have been allotted by Congress.

Right close to Bonneville Dam a recent facility has been put in which promises to actually make much more economical fish passage facilities over these dams. This is the interior of this fish passage laboratory at Bonneville Dam and shows the general tank itself. Here are ladders of various kinds and various widths and various styles to be tested. Here are two ladders being tested with the fish free. They come up the ladder and transfer into this particular ladder without being hampered by man. They are subject to different conditions. They are tested as to which they prefer.

What we are finding is that salmon will actually choose narrower and steeper ladders than we have been constructing. The laboratory studies are now being tested on a broader scale and will mean millions of dollars in savings if these smaller ladders with steeper gradients can be used.

The cost of this particular research will be many times saved in even one dam with the smaller fishways if these laboratory studies turn out successful in pilot-plant operations.

Another finding on the west coast is the finding of electrical fish guiding devices. We can guide fish along the face of various electrodes with current. One of these particular electrical fish guiding

devices—here is the laboratory. This particular slide is out of place. This takes the fish out of a Bonneville fishway into the laboratory, puts them back into the fishway in the upper end of the laboratory, and here is where the tests on different designed fishways are conducted.

Fishways at dams are major expenditures. At McNary Dam the fishways probably cost in the neighborhood of perhaps as much as between 15 and 20 million dollars. We think we can by a proper design cut that cost even in half by these particular studies. Utilizing the results of these studies that are being carried out, we think this is possible.

Before going to the Great Lakes, we found by utilizing the electric weir below the Brownlee Dam, which is being constructed on the Snake River, that we can collect the adult salmon efficiently and economically without putting a major barrier in here, which would cost many times more than this electric barrier.

Here again in the Pacific Northwest our research is actually being turned into practical ways of saving money and providing for the maintenance of the salmon runs in a more economical manner.

I am sure most of you are aware that in the Great Lakes in recent years we have had a terrific scourge of sea lampreys.

The CHAIRMAN. Before starting that, let me ask a question about salmon.

Was an effort made to transplant salmon to the North Atlantic?

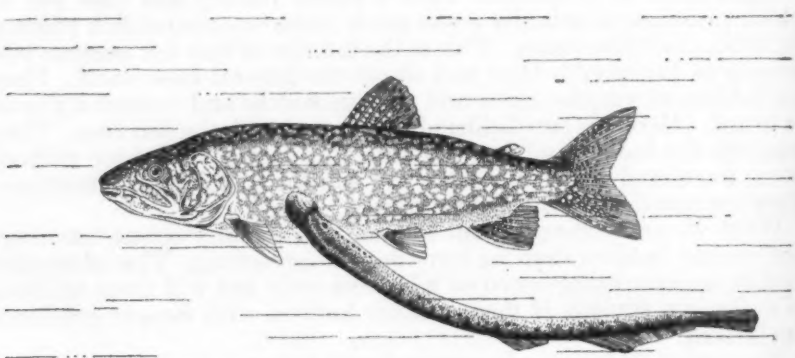
Mr. MCKERNAN. Yes, there has been.

The CHAIRMAN. With no success?

Mr. MCKERNAN. There has been some limited success, Mr. Chairman, and in fact these runs have come back, for example, maybe one or two cycles but have finally died out naturally.

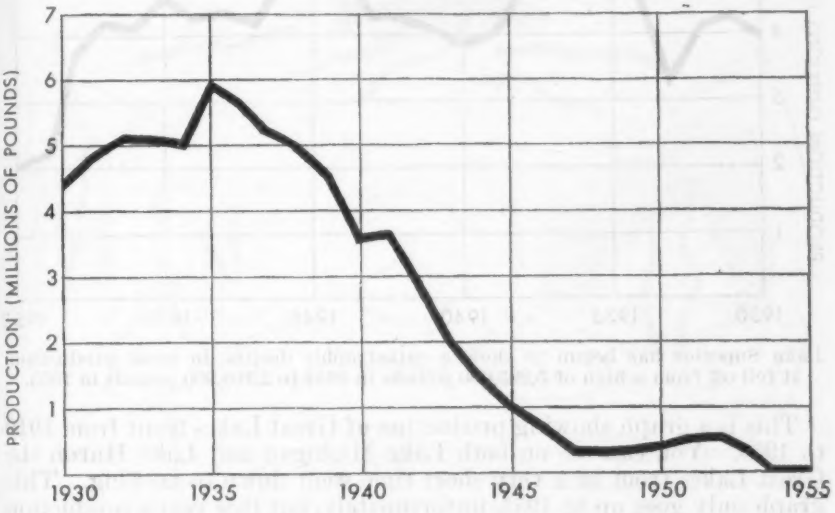
The CHAIRMAN. Go ahead.

Mr. MCKERNAN. This does not necessarily mean that with considerable expenditure of money this could not be accomplished, but it at least has not been so far.

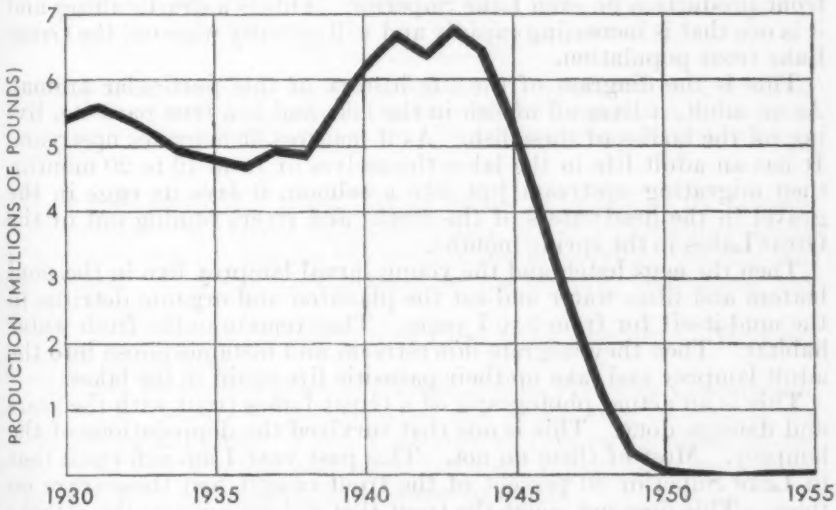


SEA LAMPREY FEEDS on a lake trout. The lamprey may remain attached to a fish for weeks. Some fish, however, die in as little as four hours. The adult lamprey ranges from 12 to 24 inches in length. Its back is dark blue and its belly silvery white.

The sea lamprey have come into these upper Great Lakes in recent years, and production of the famous Great Lakes trout has gone down to almost nil. This is the sea lamprey itself with its very imposing name of petromyzon marinus. It has a raspy mouth and tongue which has almost a file-like contour to it. It grabs hold of the fish in the lakes and simply devours it in a very harsh manner.



Lake Huron produced 5,998,000 pounds of lake trout in 1935 and less than 50 pounds in 1955. At 1950 dockside prices, the 1935 catch was worth $2,999,000; the 1955 catch, only $5.



Lake Michigan produced 6,860,000 pounds of lake trout in 1943 and less than 50 pounds in 1955. At 1950 dockside prices, the 1943 catch was worth $3,340,000; the 1955 catch, only $19.

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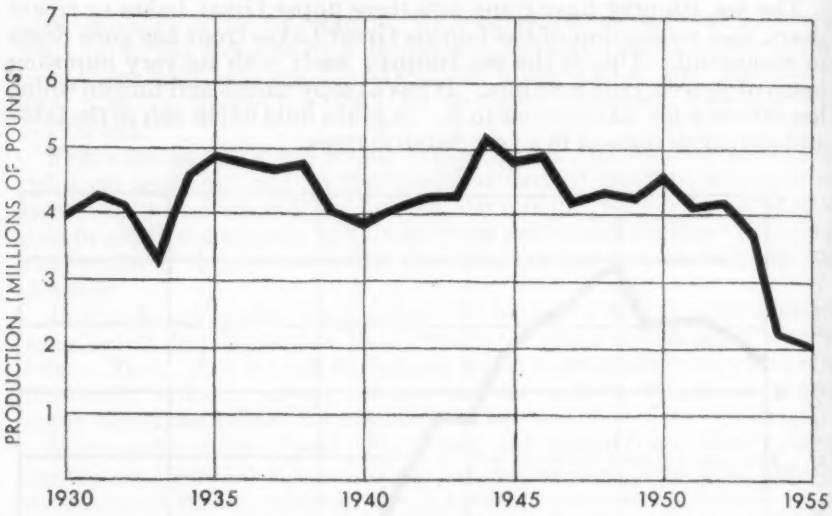


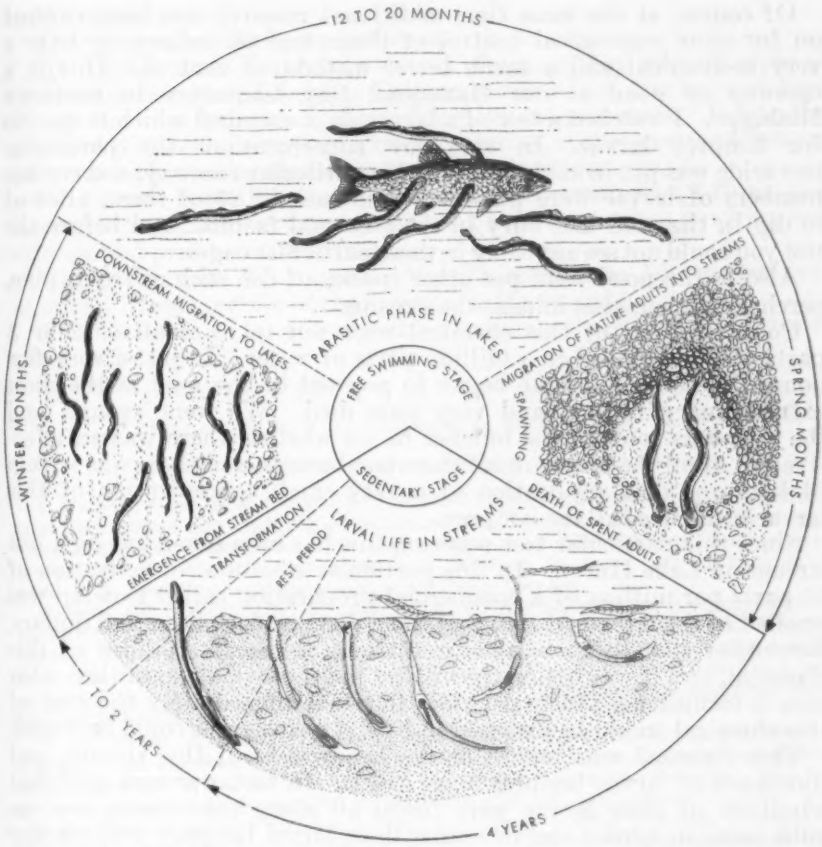
Lake Superior has begun to show a catastrophic decline in trout production. It fell off from a high of 5,293,000 pounds in 1944 to 2,100,900 pounds in 1955.

This is a graph showing production of Great Lakes trout from 1910 to 1955. You can see on both Lake Michigan and Lake Huron the Great Lakes trout in a very short time went down to nothing. This graph only goes up to 1955, unfortunately, but this year's production in Lake Superior, the last lake to be hit by the Great Lakes lamprey, is down considerably less than 1 million pounds this year. In fact, predictions of our scientists are that perhaps this year is the last year of trout production on even Lake Superior. This is a drastic thing and it is one that is increasing rapidly and will actually wipe out the Great Lake trout population.

This is the diagram of the life history of this particular animal. As an adult, it lives off of fish in the lake and is a true parasite, living off the bodies of these fish. As it matures, it migrates upstream. It has an adult life in the lakes themselves of from 12 to 20 months, then migrating upstream just like a salmon, it lays its eggs in the gravel in the headwaters of the creeks and rivers coming out of the Great Lakes in the spring months.

Then the eggs hatch and the young larval lamprey live in the mud bottom and filter water and eat the plankton and organic detritus in the mud itself for from 5 to 7 years. They remain in the fresh water habitat. Then they migrate downstream and metamorphose into the adult lamprey and take up their parasitic life again in the lakes.

This is an actual photograph of a Great Lakes trout with the scars and damage done. This is one that survived the depredations of the lamprey. Most of them do not. This past year I am informed that in Lake Superior 80 percent of the trout caught had these scars on them. This does not count the trout that did not survive the attacks by the Great Lakes lamprey.



Life cycle of the lamprey is depicted in this chart. The lamprey lives 6½ to 7½ years. The size of the segments in the chart do not correspond to the length of time the lamprey spends in each stage. The lamprey spends most of its life as a larva.

It is not specific for trout. Trout seems to be one of its favorite foods, but these are Great Lakes white fish, and this particular species of parasite, when it finishes the trout, there is no telling what it will attack next. Our scientists inform me the lamprey will attack any species of fish.

Here is an actual photograph of these adult lampreys. They are about 24 inches long.

You may remember there is a Great Lakes Fisheries Commission, which with Canada is investigating and attempting to control the Great Lakes lampreys. I am a member of that commission, by the way, as of last summer and have followed, I have been very much interested in the development of control measures.

This is an electric weir put across a stream. When the lamprey come up and enter this field, the adult lamprey, they are killed. Thousands of these particular fish have been killed every year since they were put in. Most of the streams adjacent to Lake Superior and Lake Michigan have been weired in this particular fashion.

Of course, at the same time additional research has been carried on for more economical control of these, and we believe we have a very economical and a much better method of control. This is a raceway or pond at our Hammond Bay laboratory in northern Michigan. I watched a test of a larvacide, a chemical which is specific for lamprey larvae. In very low concentrations the particular larvacide was put in at the head of this particular raceway, and certain numbers of larvae were put into these baskets, 25 of them, allowed to dig in the mud and bury in their normal fashion, and before the test you could not see anything in these particular cages.

Also in the pond were put other species of fish such as trout, pike, perch, and others that inhabit the streams.

Concentrations of this chemical were put in as small as 2 or 3 parts of the chemical in a million parts of water. In just a very few hours the lamprey larvae began to pop out of the mud in the most extraordinary fashion and very soon died. We went around and the scientists counted the number to see whether there was an effective kill of all the larvae in all these test baskets, and there was within 24 hours of that application of a very small concentration of this larvacide a kill of all the lamprey.

Since this particular test was run, this has been taken out on a test stream on Lake Huron. In this particular stream a concentration of 30 parts per million of a commercial preparation called Dowlap was applied to the stream at a cost of some three or four thousand dollars. Remember that this manufacturer was a new manufacturer of this chemical, and it was not on the market in commercial quantities. Our men informed me afterward they felt that immediately the cost of this chemical would be dropped in half if any market could be found.

This chemical was put in at the headwaters of this stream, and thousands of larvae lamprey were killed. In fact, our men said that windrows of these larvae were found all along the stream, and sea gulls came in hordes and devoured these larval lamprey without any ill effects to themselves. There were very few fish of a desirable nature killed in the test, and the test itself was between 95 and 100 percent effective. The 5 percent of ineffectiveness, by the way, it is interesting to note that that occurred at the mouth of the stream where there was a greater dilution from the lake. For example, winds pushed water up in the stream and there was considerable dilution. Beyond the mouth up in the stream there was 100 percent kill. Going in later on and testing in the mud and sand flats, no larvae were found.

As a result of this, we are attempting to reorient this program and effectively use what appears to be a much more economical way to eliminate these particular larval lamprey.

Remembering too that this will save us 5 or 6 or even 7 years, if we can eliminate the larvae, because the total life history until they come upstream is up to 7 years, this promises to be a very economical adjunct to the lamprey control program.

Mr. GROSS. The lamprey have to come out of the Lake and into the small streams, is that correct? They do not reproduce in the Lakes?

Mr. MCKERNAN. They do not reproduce in the Lakes. They have to come up in the streams, as far as we know.

The CHAIRMAN. Were the lamprey in the Lakes prior to opening of the Lakes by the canal?

Mr. McKERNAN. Yes.

The CHAIRMAN. They are in the sea.

Mr. McKERNAN. Yes, but in the sea of course they have all sorts of these trash fish, the pollocks and bottom fishes which for the most part are not used much commercially. They are not so serious. It is in the confined environment of the Lakes where most of the species of fish are very valuable species that they do their worst damage.

Mr. GROSS. I would like to say to Mr. McKernan that I think you have made an excellent presentation. I have listened to it with great interest and profit. I thank you.

Mr. McKERNAN. Thank you. Mr. Chairman, may I have your permission to insert certain of the material in the record?

The CHAIRMAN. I want this list of studies inserted at the proper place in the record.

(The list referred to follows:)

BUREAU OF COMMERCIAL FISHERIES

ACTS AUTHORIZING FISHERY ACTIVITIES IN LAST 10 YEARS

1. *Fishery Education Act of 1956 (70 Stat. 1126).*—Authorizes grants to education institutions and training of technical personnel needed in the field of commercial fishing. For fiscal 1958 appropriation of $228,000 was made to the Department of Health, Education and Welfare to carry out provisions of section II. No other appropriations made under this act.

2. *Fish and Wildlife Act of 1956 (Stat. 1119).*—Establishes a comprehensive national policy on fish and wildlife resources, reorganizes the Fish and Wildlife Service, sets up a $10 million revolving Fisheries Loan Fund, and makes permanent the Saltonstall-Kennedy Act (#5 below). The Fisheries Loan Fund was activated in October 1956 and by December 1957, 182 loans were approved for a total of $4,852,534.

3. *The Great Lakes Fishery Act of 1956 (70 Stat. 242).*—Authorizes conduct of research and lamprey control programs of the Great Lakes Fishery Commission established by the Convention between the United States and Canada. The two governments contribute equally to maintain a small administrative staff. The Commission formulates and carries out a lamprey control program financed 69 percent by the United States and 31 percent by Canada. Other research is performed by the research agencies of the respective governments with the Commission acting as coordinator of the program. Congress appropriates to the Bureau for its research and to the State Department for the lamprey control program. The Commission may do its own research if necessary, but at present, it does not maintain a research staff. Appropriations made were: To State Department for lamprey control, fiscal 1957, $615,000; fiscal 1958, $915,000; for Bureau research, fiscal 1957, $135,000; fiscal 1958, $150,000.

4. *The North Pacific Fisheries Act of 1954 (68 Stat. 698).*—Authorizes conduct of scientific programs and regulation as provided under the International North Pacific Fisheries Commission. Member governments contribute equally to support a small administrative staff. Research is performed by the respective research agencies of the member governments. Congress appropriates directly to the Bureau for Commission research. The Commission is to make full use of existing research agencies, but may do its own research. At present, it does not maintain a research staff. Appropriations made for research were: fiscal 1956, $730,000; fiscal 1957, $730,000; fiscal 1958, $730,000.

5. *The Saltonstall-Kennedy Act of 1954 (68 Stat. 376) as amended in 1956 (70 Stat. 1119).*—Earmarks 30 percehnt of tariff receipts on fishery products for conduct of technological, biological, marketing research, and educational services. The 30 percent of duties available were as follows: fiscal year 1955, $4,207,926; fiscal 1956, $4,321,403; fiscal 1957, $4,359,115; fiscal 1958, $4,651,151. Expenditures of these funds were: fiscal 1955, $2,853,239; fiscal 1956, $2,999,479; fiscal 1957, $5,824,241; fiscal 1958, $5,584,070 estimated. In fiscal 1955 and 1956 expenditures were limited to $3,000,000 annually by the act. Fish and Wildlife Act of 1956 removed limitation and made full 30 percent and accruals available until expended.

6. *The Northwest Atlantic Fisheries Act of 1950 (64 Stat. 1067).*—Authorizes enforcement of the provisions of the International Convention establishing the International Commission for the Northwest Atlantic Fisheries. This Commission has a 4-member administrative staff financed by all 10 member nations. Research is done by the respective research agencies of the member governments. Congress appropriates directly to the Bureau for Commission research. Appropriations were: fiscal 1952, $18,520; fiscal 1953, $29,650; fiscal 1954, $29,650; fiscal 1955, $29,500; fiscal 1956, $39,600; fiscal 1957, $41,550; fiscal 1958, $59,500.

7. *The Tuna Convention Act of 1950 (64 Stat. 777).*—Authorizes conduct of scientific programs at the request of the Inter-American Tropical Tuna Commission established by the Convention. The Commission has its own research staff. Appropriations for the Commission are made by the respective governments based on the benefit principle of sharing in the costs. In the United States the funds are requested through the Department of State. Thus, the United States is now paying about 98 percent of these costs. No other funds expended by the United States for this Commission. Appropriations made were: fiscal 1952, $59,991; fiscal 1953, $58,100; fiscal 1954, $110,450; fiscal 1955, $115,445; fiscal 1956, $197,290; fiscal 1957, $352,725; fiscal 1958, $362,500.

8. *The Farrington Act of 1946 (61 Stat. 726).*—Authorizes study of the high seas fishery resources of the Territories and island possessions of the United States in the tropical and subtropical Pacific Ocean. Appropriations for this activity were: fiscal 1950, $1,500,000; fiscal 1951, $832,900; fiscal 1952, $739,562; fiscal 1953, $757,066; fiscal 1954, $727,000; fiscal 1955, $642,000; fiscal 1956, $642,000; fiscal 1957, $660,000; fiscal 1958, $683,000.

9. *The act of July 11, 1957 (71 Stat. 293) amending the Sockeye Salmon Act of 1947 (61 Stat. 511).*—Provides for the regulation and protection of the fishery for Fraser River pink salmon in addition to the sockeye salmon. The International Pacific Salmon Fisheries Commission has its own research staff. Appropriations are made for the Commission by the respective governments. In the United States the funds are requested through the Department of State. No other funds expended by United States for this Commission. Appropriations made: Fiscal 1949, $103,100; fiscal 1950, $211,200; fiscal 1951, $127,963; fiscal 1952, $138,760; fiscal 1953, $135,979; fiscal 1954, $135,000; fiscal 1955, $139,500; fiscal 1956, $141,295; fiscal 1957, $173,550; fiscal 1958, $261,050.

10. *The Whaling Convention Act of 1949 (64 Stat. 421).*—Provides for regulation of whaling by United States nationals. There is 1 United States whaling operation involving about 4 licensees. Appropriations are made directly to the Bureau for administration and enforcement of the regulations under the International Whaling Commission. Appropriations made: Fiscal 1951, $10,219; fiscal 1952, $17,228; fiscal 1953, $18,304; fiscal 1954, $18,304; fiscal 1955, $10,000; fiscal 1956, $10,800; fiscal 1957, $11,300; fiscal 1958, $11,300.

11. *The act of August 25, 1950 (64 Stat. 474).*—This act authorizes continuing studies of Atlantic coast fish species for developing and protecting fish resources. The Bureau's South Atlantic fishery investigations was established under the act. Research has been directed toward establishing the potential productivity of these waters as a guide to the possibility of extending present fisheries and of developing new ones. Initial surveys have been completed. Oceanographic, chemical and biological data is being analyzed and reported. Appropriations made for fiscal 1952 through 1958 were $90,000 each year.

12. *The act of May 19, 1949 (63 Stat. 70).*—The act consents to the establishment of the Gulf States Marine Fisheries Commission, an interstate compact organization. It designates the Fish and Wildlife Service as the primary research agency to promote better utilization of Gulf of Mexico fish and shellfish resources. Close cooperation in planning Bureau programs is maintained with the Commission. Cooperation with individual States has been has been mutually valuable in all fields of fishery activities. No separate specific appropriations are made for these activities.

13. *The act of August 18, 1949 (63 Stat. 616).*—Authorizes a comprehensive and continuing study of Atlantic shad for purpose of making recommendations to Atlantic Coast States for measures to arrest decline of stocks, increase abundance, and promote wise utilization. Investigations to provide basic data have been carried out in all the major shad streams of the Atlantic coast, from headquarters at Beaufort, N. C. Regulations based on recommendations of the Bureau, and resulting from research findings, have been accompanied by an increase in catch in the Hudson and Connecticut Rivers. Appropriations made

for this activity were: Fiscal 1950 through 1953, $101,000 each year; fiscal 1954, $75,000; fiscal 1955, $83,800; fiscal 1956, $84,000; fiscal 1957, $87,000; fiscal 1958, $92,000.

14. *The act of May 26, 1948 (62 Stat. 274).*—Authorizes investigations of biology, propagation, etc., as a basis for recommending measures to arrest depletion, restore production, develop new beds for hard-shell and soft-shell clams. Work has resulted in finding that reduction of soft-shell clams is due to predation by green crabs, and to development of fences and poison baits for controlling this predator. Hard-clam study has shown the trend of abundance of the stock in Narragansett Bay. Artificial propagation methods are being developed. Appropriations were: Fiscal 1943, $20,000; fiscal 1950, $92,000; fiscal 1951, $92,000; fiscal 1952, $90,000; fiscal 1953, $90,000; fiscal 1954 through 1958, $85,000 each year.

TRAINING OF PERSONNEL IN THE FISHING INDUSTRY

The Fishery Education Act of 1956 (70 Stat. 1126) authorizes $550,000 for section I which provides for college grants, and $375,000 for section II which concerns vocational training in the fishing industry and distributive trades therein. The House approved an appropriation of $350,000 for section I, and no funds for section II. The Senate voted no funds for section I, and $375,000 for section II. The 85th Congress finally appropriated no funds for section I, and $228,000 for section II.

Section II is administered by the Department of Health, Education, and Welfare through the Office of Education. To date, allocations have been made to the States and Territories on the basis of their respective importance within the total United States fishing industry, and curriculum planning sessions have been held at the National and State level.

FISHERIES LOAN FUND

One of the urgent needs of the commercial fishing industry was met through the Fish and Wildlife Act of 1956 by the establishment of a loan fund to help owners of fishing vessels and gear. The broad objective of this fund is to provide financial assistance which will aid the industry to bring about a general upgrading of the condition of both fishing vessels and fishing gear in order to conduct more efficient and profitable fishing operations.

The act authorized $10 million to provide initial capital as a revolving fund for these loans. The rate of interest on all loans granted is fixed at 5 percent a year. All loans must mature in not more than 10 years. Under the terms of the act, a loan may not be granted unless reasonable financial assistance applied for is not otherwise available on reasonable terms.

The fisheries loan fund started operations October 22, 1956. As of December 18, 1957, the status of loan applications was as follows:

Applications received	348	$13,311,671
Applications withdrawn	19	1,079,226
Loans approved	182	4,852,534
Loans declined	65	1,724,602

Collections of principal and interest exceeded $100,000 by the end of November 1957. As action on several large applications has been temporarily suspended at the applicant's request, funds are available for handling applications currently being received.

GREAT LAKES SEA LAMPREY CONTROL AND RESEARCH, AND LAKE TROUT REHABILITATION

Research over the past 5 years resulted in the development of effective and economical electrical methods for control of adult sea lampreys on their upstream spawning migration. These devices have been installed on all Lake Superior streams known to have spawning runs of lampreys. Because these devices kill all migrating fish, a direct current leading device has been developed and placed in operation on all streams having large runs of fish, with the result that mortality has been reduced about 98 percent. Gratifying progress has been made in the past year in the development of several toxicants that are specifically toxic to sea lamprey larvae. The larvae spend from 5 to 7 years as nonparasitic individuals in the bottom mud of streams. Each year a new generation of parasites migrates to the lakes to start feeding on fish.

The first stream trial, conducted in late October 1957, indicated that at least 97 percent of the larvae were killed. This method, together with electrical barriers promises to reduce the time required for lake trout rehabilitation by about 5 years.

Plans are now being made to start treating Lake Superior streams with those toxicants and at least six streams will be completed this fiscal year. Lake Superior still has a small residual stock of lake trout for natural spawning. In addition, planting of marked hatchery trout is planned to begin next calendar year and will be continued for from 5 to 10 years.

NORTH PACIFIC HIGH SEAS SALMON RESEARCH

The International North Pacific Fisheries Commission (Japan, Canada, the United States) was set up to provide for conservation of the salmon stocks of the North Pacific Ocean and for the equitable division of the catch between the Asian and North American nations. The United States, as its part of the program under the Commission, has been performing since 1955 one of the largest oceanic fishery investigations in history. Most of the research to date has been devoted to determining whether an area of intermixture of North American and Asian salmon stocks exists, and what line or lines would best separate these stocks. Such information will provide the basis for renegotiation of the provisional abstention line at meridian 175° west, east of which Japan has under treaty agreed not to fish for salmon.

Abstention line research has been pursued using five major techniques: (1) Comparison of counts of body structures such as fin rays and gill rakers; (2) comparison of the markings on salmon scales; (3) testing of salmon blood serum reactions; (4) identification and enumeration of parasites; (5) tagging and recovery of fish on the high seas. All of the first four techniques utilize samples of salmon taken by the commercial fisheries and by scientists, both ashore and on the ocean.

The most complete results to date are for red salmon. A synthesis of results from all lines of investigation indicates that red salmon from North American streams occur in substantial numbers as far west as 170° east, with an area of equal abundance of Asian and North American fish at 170° east to 175° east. Information for chum and pink salmon, the other two important high-seas species, is less complete.

NORTHWEST ATLANTIC PROGRAM

Period of studies

The Bureau has been conducting research on haddock found in the Gulf of Maine and on Georges Bank since about 1932. In 1955, research was commenced on many other species as a result of the Saltonstall-Kennedy Act. Studies are now being conducted on herring, ocean perch, whiting, cod, sea scallops and on a group of fish known as industrial species.

Accomplishments

A mesh regulation has been devised and placed into effect in the haddock fishery on Georges Bank with the aim of increasing production by preventing the capture and destruction of small, unmarketable fish. Preliminary assessment of the effect of the regulation shows that the new gear is at least 10 percent more effective than the old and that total increases in production could reach 30 percent over an extended period. However, several years must elapse before the final effects of the regulation can be measured.

The general features of the biology and life history of the several species under study have been defined and estimates of abundance made. This knowledge will serve as a basis for conservation measures in the future, should further research demonstrate the need for them.

Extensive spawning grounds for herring have been located on Georges Bank and the movements of the young have been traced, by water currents, into the New England coast.

Experiments with trawl nets show that ocean perch and whiting will escape easily through the meshes so that young of these species can be protected. Tagging and age growth studies show that ocean perch grow very slowly.

Migration patterns for cod have been traced showing that one group moves between southern New England and New Jersey waters. Georges Bank cod also move to the Gulf of Maine. As a whole, cod stocks of New England are believed to be stable groups.

The age, growth, mortality and movements of sea scallops have been investigated. Preliminary estimates show that scallop production can be increased by enlarging the rings used in the dredges, thus allowing the young to escape for capture at a more desirable size.

Analysis of the catch of industrial species used for fish meal and oil and for pet food reveals that food fishes make up a minor percentage of the catch. A large industry is developing in New England based upon little used species such as hakes and skates.

Expected future accomplishments

1. Continued measurement of herring and groundfish abundance and forecasting of this knowledge for use by the industry.

2. Expansion of knowledge on the ecology of Georges Bank so that changes in availability or habits of fish can be explained and used to advantage in the fishery.

3. Firm management recommendations, for maintaining and increasing ground fish production for several species. Sea scallop production should be next for consideration, whiting and ocean perch will follow.

PACIFIC TUNA PROGRAM

Period of studies

The Bureau's Pacific tuna research program commenced in 1948 when the Pacific Oceanic Fishery Investigations were established in Honolulu. Research and explorations on equatorial yellowfin stocks were pursued first, and have been followed by studies on Hawaiian skipjack, North Pacific albacore, Marquesan skipjack and yellowfin. A new program on tuna of the central eastern Pacific was started in the fall of 1957.

Accomplishments

1. *Equatorial yellowfin program.*—An initial, systematic search for yellowfin tuna, based on knowledge of areas enriched by oceanic circulation, has paid off. Rich tuna resources have been discovered along the equator in a broad band south of Hawaii.

Economic conditions in the American industry have prevented utilization of this new resource and intensive investigation has been discontinued.

However, a remarkable relation has been discovered between yellowfin tuna availability and water temperature, which is an index of upwelling and "aging" of the waters. A means of catch prediction has been developed.

Despite the lack of United States fishing in the central equatorial Pacific, scientific results will contribute to understanding of variations in success of fishing in areas closer to the west coast.

2. *Marquesan program.*—The Bureau is now in the second year of a 3-year study undertaken at the request of the southern California tuna industry, to seek out and evaluate winter fishing grounds which can be utilized by the west coast fishermen when the catch in Central American waters usually decreases. Field work on this research ends this fiscal year (1958).

This project was primarily concerned with locating yellowfin tuna, but has resulted in locating large skipjack resources comparable with or even greater than those of the Hawaiian Islands. In the Marquesan area this species occurs most abundantly in the winter—a mirror image of conditions in the northern hemisphere.

A detailed study of seasonal abundance in relation to oceanographic conditions is now being completed. This knowledge will be invaluable to our understanding of variations in success of skipjack fishing in both Hawaii and off the west coast of the Americas.

3. *Hawaiian skipjack program.*—An intensive study of factors causing variations in availability of fish to the fisherman and to reduce scouting time and cost of production is now underway for the Hawaiian skipjack fishery. Detailed studies of the environment in relation to occurrence are being pursued. These include monitoring of fixed midocean environmental stations and analysis of records from steamships to predict variations in conditions which influence skipjack availability. As a part of this study, monthly charts of temperature anomalies are being prepared.

Studies on movements and migrations of skipjack are most productive because of the development of a "dart tag" by the Bureau. Local areas where skipjack are known to occur consistently are being studied intensively to explain environmental factors responsible for the presence or absence of skipjack.

How and when tuna feed, the role of water enrichment and abundance of food, and investigations into augmentation of the bait supply for commercial fishing are all contributing to improvement of the Hawaiian skipjack fishery. Results will lead to a better understanding of tuna behavior elsewhere in other fisheries.

4. *North Pacific albacore program.*—This program, financed through the Saltonstall-Kennedy Act, is now in its third year. A general survey of albacore distribution is nearly completed. Last year, as part of the distribution study, 8 commercial trollers and 2 Bureau vessels undertook a coordinated survey off the west coast of the United States. The distribution pattern was studied and several hundred fish were tagged. Results of this and other tagging show that albacore make long migrations. It is now apparent that both the Japanese and Americans are fishing the same stocks.

Large albacore resources have been located in the area below the Aleutian Islands. Cruises of research vessels in these waters have also assisted in the studies of high seas salmon.

Studies on the factors reponsible for fluctuations in availability are also being pursued.

5. *Central Eastern Pacific program.*—Research on tuna stocks of the central eastern Pacific was started this fall for the purpose of reducing the time now required for American fishermen to locate and make their catch. The primary aim of these studies is to reach an understanding of the chain of events in air circulation; water circulation, primary production, secondary production (tuna food) to catchable tuna. If the chain of events controlling the presence or absence of catchable tuna at a partiular time and place is understood, it should be possible to predict this and thus be of direct aid by telling fishermen what areas at what times will be most productive.

This program is now being actively pursued.

General

The Pacific Oceanic Fishery Investigations' extensive ocean monitoring program and oceanographic surveys are of value to research on salmon, sardines, and other west coast fisheries. For example, oceanwide accumulation of data on hydrographic conditions in 1957, an unusually warm year, has contributed greatly to understanding of influences on salmon migrations and Pacific sardine spawning.

Expected future accomplishments

1. Completion of the Marquesan survey to explain seasonal abundance and relations between tuna and oceanographic features of eastern French Oceania.
2. Definition of factors causing variations in availability of fish to Hawaiian skipjack fishermen. Reduce scouting time and cost of fishing.
3. Improve the line bait supply for the Hawaiian fishery.
4. Definition of the response of tuna to live bait and their behavior in fishing conditions to improve fishing methods. Knowledge will be useful in all United States tuna fisheries.
5. Explanation of factors responsible for fluctuations in availability of albacore. Aid the west coast industry by explaining where and when the best summer catches can be made.
6. Intensification of Eastern Pacific tuna programs; prediction of times and places of good tuna fishing so as to reduce fishing effort and operational costs.
7. Documentation of the broad features of mid-Pacific ocean conditions; explanation of variations in temperatures and circulation as these relate to major fisheries.

Division of Biological Research, fiscal year 1958

Activity and station	Research vessels	Permanent personnel	Regular	Saltonstall-Kennedy Act	Funds reimbursable	Contract	Work	Total
Pacific region: 1								
Seattle, Wash., salmon and related species		97	$1,169,200	$122,700	$111,200			$1,403,100
La Jolla, Calif., sardines and related species	Black	45	130,200	121,000		$60,000		311,200
Whales	Douglas	1	11,300					11,300
Stanford, Calif., fluctuations in North Pacific fisheries		6		45,000				45,000
Gulf and South Atlantic region 2:								
Galveston, Tex., shrimp, red tide, Gulf menhaden	Kingfish	51	110,500	339,500				450,000
Beaufort, N. C., Atlantic menhaden		11		83,000		9,000		92,000
Shad, striped bass, blue crab		19	92,000	60,600				152,600
Radiobiological studies		9	20,500	30,000	45,000			95,500
Brunswick, Ga., South Atlantic fisheries		15	85,000					85,000
Pensacola, Fla., Gulf oysters and fresh-water mussels		9	42,000	26,300	2,850	12,500		83,650
North Atlantic region 3:								
Woods Hole, Mass., North Atlantic trawl fishes and scallops	Albatross III	75	228,000 597,081	413,000				1,238,081
Shellfish Laboratory		3	16,000					16,000
Boothbay Harbor, Maine, Atlantic herring		15		99,000			$50,000	149,000
Milford, Conn., Shellfish Laboratory	Shang, Wheeler	10	46,300	26,500		1,700		74,500
Annapolis, Md., Shellfish Laboratory	Alosa	26	120,200	82,000				202,200
Great Lakes and Central region 4: Ann Arbor, Mich., sea lamprey control and rehabilitation of Great Lakes fisheries	Cisco, Siscowet, Musky	79	151,150	111,900		746,450		1,009,500
Pacific Oceanic Fisheries Investigation, Honolulu, T. H., tuna and bait fishes	Hugh M. Smith, Charles H. Gilbert	92	677,300	230,350	36,000			943,650
Washington, D. C., field:								
Ichthyological Laboratory		2	18,300					18,300
Atl. Fish. Ocean Research		1		16,000				16,000
Central office, District of Columbia		10	127,350	22,550				149,900
Total, field stations, 17	10	576	3,642,381	1,829,400	195,050	829,650	50,000	6,546,481

DIVISION OF BIOLOGICAL RESEARCH

Source of funds other than regular and Saltonstall-Kennedy

Working funds: Department of State, Passamaquoddy survey	$50,000
Reimbursable funds:	
Atomic Energy Commission	45,000
Idaho Power Co	3,000
Public Utilities	25,000
Public Health	2,850
Navy	30,500
International Geophysical Year	5,500
Corps of Engineers	63,200
Columbia River	20,000
Total	195,050
Contributed funds:	
Great Lakes Fishery Commission	776,450
E. I. du Pont de Nemours Corp	21,500
Yale University	1,700
Marine Research Committee	60,000
Total	859,650

Research activity	Headquarters	Substations
Pacific salmon investigations	Seattle, Wash	North Bonneville, Wash. Los Molinos, Calif.
South Pacific fishery investigations	La Jolla, Calif	San Diego, Calif.
Ocean research	Stanford, Calif	
Gulf fishery investigations	Galveston, Tex	St. Petersburg, Fla.
Middle Atlantic fishery investigations	Beaufort, N. C	
Atlantic menhaden investigations	do	Cape May, N. J. Millville, Del.
Radiobiological fishery investigations	do	
South Atlantic fishery investigations	Brunswick, Ga	
Gulf oyster investigations	Pensacola, Fla	Decatur, Ala.
North Atlantic fishery investigations	Woods Hole, Mass	Boston, Mass. Gloucester, Mass. New Bedford, Mass. Port Judith, R. I. Portland, Maine. Rockland, Maine.
Woods Hole Shellfish Laboratory	do	
Milford Shellfish Laboratory	Milford, Conn	
Clam and Chesapeake oyster investigations	Annapolis, Md	Boothbay Harbor, Maine. Franklin City, Va. Kingston, R. I.
Atlantic herring investigations	Boothbay Harbor, Me	
Great Lakes fishery investigations	Ann Arbor, Mich	Rogers City, Mich. Marquette, Mich. Ludington, Mich. Grand Haven, Mich. Ashland, Wis. Oconto, Wis. Sandusky, Ohio.
Pacific Oceanic fishery investigations	Honolulu, T. H	
Atlantic Fishery Oceanographic Research Center.	Washington, D. C	

17 research activities—23 substations.

PACIFIC SALMON INVESTIGATIONS

Period of studies

The two fields of study described here have been entered in relatively recent years. Small scale North Pacific salmon research began in 1952, but the full-scale program did not get underway until 1955. Columbia River fish protection research began with study of square-wave current effects on fish, in 1951. Here again, however, the full-scale program did not begin until 1954. Thus these two programs have had only three or four seasons of intensive work to accomplish the results reported below.

Accomplishments

Covering an area of some 3 million square miles, biologists of the Bureau's research teams conducted a vast oceanic study of the salmon in the North Pacific Ocean and the Bering Sea. They attacked the problem of identifying North American and Asian stocks of salmon by five techniques: (1) comparison of body structures such as fin rays and gill rakers, (2) comparison of surface markings of scales, (3) testing of salmon blood serum reactions, (4) identification and enumeration of parasites, (5) tagging and recovery of salmon on the high seas. All of these techniques were successful in identifying the origin of unknown fish taken on the high seas. It was demonstrated for red salmon that fish of North American origin occur as far west as meridian 170° E., with the area of equal abundance of North American and Asian fish at 175° E.

Columbia River fish protection research started with laboratory study of reactions of salmon to stimuli. This was followed by the development of experimental electrical devices and their testing in small tanks and flumes. Further development of the devices led to tests in salmon streams of moderate size, where 90 to 100 percent of small salmon could be guided to a predetermined side of the stream. Finally, a full-scale application for guiding adult fish was made at Brownlee Dam on the Snake River. In the fall of 1957 this device, consisting of parallel rows of electrically energized electrodes, guided some 15,000 salmon and steelhead trout to a trap. From this they were placed in a truck to be transported above the dam and released to continue their spawning migration.

Efficient and economical fishways are necessary in order to pass salmon over dams. In the research facility at Booneville Dam, full-scale fishways are tested in a flume of about the proportions of a small navigation lock. Results of this work have been applied in recommendations for the design of fishways at Ice Harbor Dam on the Snake River. The recommended fishways will provide full fish-passing efficiency, but will be narrower and steeper than the ones now in use, thus saving substantial amounts of money.

Expected future accomplishments

1. Location of a line or lines best separating Asian and North American stocks of red, chum, and pink salmon.
2. Management of salmon resources under the International North Pacific Fisheries Commission to achieve optimum utilization.
3. Development of practical devices for guiding adult salmon on this upstream migration, and juvenile salmon on the downstream migration.
4. Production of efficient and economical fishway designs for the many large Columbia River power dams planned for construction.

COMMERCIAL SHELLFISH RESEARCH

Recent shellfish research has been primarily devoted to attacking three problems: (1) control of injurious predators, such as oyster drills, (2) location of new sources and methods of collection of clam and oyster seed, (3) development of artificial propagation methods. Work on oysters has been carried on at Milford, Conn., Woods Hole, Mass.; Annapolis, Md.; Beaufort, N. C.; and Pensacola, Fla. Clam research has been carried on at Boothbay Harbor, Maine; Kingston, R. I.; and Annapolis, Md.

In oyster drill research, several means of control have been tested, including trapping, dredging, fencing, selective poisons, and parasites. To date the most promising method tested is the use of a fence containing strands of metallic copper, which drills will not cross. Such a fence can be made flexible so that it can be paid out from a boat without work on the bottom.

Collection of oyster seed by means successfully used elsewhere, such as rafts and suspended bags, is showing promise of favorable results. Clam seed is being collected by traps making use of sand filters.

Artificial propagation of clams and oysters has been approached by field testing and biological observation of pond culture, and by basic research to gain the information needed to operate hatcheries. One item of information particularly important for hatcheries is the nature of foods satisfactory for larval oysters and clams. Several plant plankton organisms have been tested as foods, and certain ones have been discovered to be distinctly above average in furthering good survival and growth.

Biological Research on Oysters

Period of studies

The Bureau's oyster research programs have been carried on for many years. Expanded research on oyster predators and on oyster propagation, however, began in 1955 with funds provided under the Saltonstall-Kennedy Act. Thus the results of only three seasons' intensive research are reported below.

Accomplishments to date

At Milford, Conn., the plant plankton organisms utilized as food of juvenile oysters have been isolated and tested both individually and in various combinations. Certain of these organisms have been demonstrated to be outstandingly successful in producing oyster growth. Such information will be utilized in developing artificial propagation methods. Observation of spawning and growth of oysters in natural ponds on Martha's Vineyard Island, Mass., has provided information on water conditions which must be maintained for successful culture.

Several hundred chemical compounds have been tested at Milford to find ones which are valuable in controlling oyster pests. A number of these have been shown to kill oyster pests without killing the oysters themselves. In Chesapeake Bay a method of trapping oyster drills has been developed. Survival of oysters in trapped areas is superior to that in untrapped areas. A suction dredge has been developed for removing drills from areas too deep to be trapped. Also, at Chesapeake Bay a new method of collecting oyster seed is being tried. Wire mesh bags hold oyster shell clutch off the bottom, and in some tests these shells have collected twice as many spat as those spread over the bottom in the old way. A flexible fence with strands of copper has been developed and is being tested at Chincoteague Bay, Md., and Virginia. Drills will not cross the metallic copper, and are kept out of the oyster beds. Since the fence is flexible, it can be paid out from oyster boats without work on the bottom itself.

Parasites are being investigated as oyster drill controls at Pensacola, Fla. Already a parasite has been found which is destructive to the drills' liver.

Expected future accomplishments

1. Development of fully effective, practical and economically feasible oyster predator controls, using chemical, mechanical, and biological means.
2. Inception of a large-scale oyster pond culture program in seed-deficient areas.
3. Development of effective and economical devices for collecting oyster seed.
4. Location of new sources of oyster seed.
5. Development of a hatchery technique of artificial oyster propagation.

Research on the Green Crab as a Clam Predator, and Development of Control Methods

Production of soft clams in New England had declined substantially up to 1950. Scientists seeking the cause found that much of the decline was due to predation by the common green crab. This crustacean has always been present in New England, but warming of Atlantic coastal waters during the past century has permitted its northward spread in much greater abundance than formerly.

Having established the adverse effect of the green crab on the soft-clam stocks, biologists sought methods of controlling this predator. One method tried was to cover the clam beds with wire or plastic mesh. This method was successful in keeping out green crabs, but was abandoned because of the expense and the difficulty in holding the mesh in place.

More successful than the mesh covering was fencing. Low fences were built of hardware cloth supported by wood frames. The most successful fences have a metal flange at the top to keep the crabs from crawling over. This method of green-crab control is economically feasible, particularly where the clam beds are in coves whose mouths can be closed to crabs by relatively short fences.

Poison baits have been successfully tested in some areas. Pieces of fish are saturated with the commercial poison Lindane, and placed on the clam beds where crabs can reach them. Care is taken not to place this bait where it can be reached by lobsters. By use of this baiting technique, significant reductions in the populations of green crabs have been achieved.

Pacific Sardine Studies

During the 1946–47 fishing season the Pacific sardine catch failed and in the years that have followed the catch has been less than 100,000 tons when previously it had averaged over 500,000 tons.

An expanded program of biological and oceanographical research was started in 1949 by the Service and several cooperating California agencies to determine the causes underlying the failure and to study the chances for recovery of the fishery.

Although much information has been produced about Pacific sardines and species associated with them, scientists on the program have been unable to explain exact causes of the failure.

The research has shown that there are now three major spawning areas, one off southern California, one off central Baja California and one inside the Gulf of California.

The population in the north, which supported the previous large fishery, either died off or else contracted to the south into Mexican waters. Except for 1957 there has been no spawning success on the southern California grounds for many years.

Last spring there was fairly heavy spawning close inshore along southern California. Young fish have been sighted along the coast and have been taken in the line-bait fishery. Water temperatures in 1957 have averaged 3° C., higher than the average for the past 7 years. This may be a "break" in sardine research and we are eagerly awaiting further results in the hope that conditions favorable for sardines have returned to southern California.

STRIPED BASS (ROCKFISH) RESEARCH

Objectives of Atlantic coast striped-bass research are determination of catching rates to achieve maximum yield, and development of measures to protect stream-spawning fish from the effects of industrialization. For the past 4 years this research has been a cooperative effort through the Atlantic States Marine Fisheries Commission, involving the States of Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Maryland, Virginia, North Carolina, and South Carolina, and the Fish and Wildlife Service. The State work has been largely financed under the Federal aid program.

Investigation of catching rates has been stimulated by claims of sport fishermen that commercial fishermen are overexploiting the resource. As yet there is no scientific evidence to back or to refute such claims. Information is now being accumulated for the major spawning area, Chesapeake Bay. Tagging and recovery of large numbers of fish has provided data that are now under analysis.

In the Ronoke River, North Carolina, the spawning area of the striped bass has been determined. Experimental investigation is showing what quality of water is needed for survival of the adult spawners and their larval progeny. With this information at hand, it will be possible to arrange for streamflows over dams to provide the necessary dilution of polluting substances such as pulp-mill wastes.

The cooperative Federal-State program has produced a considerable amount of the type of basic information necessary for any fishery biological study. This includes location and extent of spawning areas, migrations, distribution, age composition, growth rate, racial identity.

SHRIMP STUDIES

Shrimp support the most valuable fishery we have in terms of dollar value. The catch in 1955 was worth $62 million to the fisherman. Our shrimp industry of the gulf and South Atlantic coast is dependent upon three species, the white, brown, and pink shrimp. Only the white shrimp has been studied in the past.

Research is now underway to determine the biology of the shrimp species, the effects of environmental changes on abundance, the optimum size of capture, and the effects of the fishery on the stocks. The ultimate goal is to provide recommendations for management of the shrimp resource which will provide the maximum sustained yield.

Of particular importance is a new study of the pink shrimp fishery in the Tortugas area, as a dispute has arisen between industry and the State of Florida over management of this fishery. Meetings have been held between the United States and Cuba relative to establishing an International Commission for the management of this fishery.

Supporting the biological studies is a large statistical program. This is being undertaken to determine the significance of the gulf bait shrimp fishery and to provide basic data for evaluating the present condition of the whole fishery. This will allow us to recognize future changes in abundance, shifts in distribution, or changes in composition of the stocks.

THE RED TIDE PROBLEM

Along the Florida gulf coast from Tarpon Springs south to about Cape Romano, occasional mass fish kills occur which have been commonly called "red tides." It has been determined that a microscopic dinoflagellate, *Gymnodinium breve*, is the cause. Red tides litter the beaches with rotten fish, cause residents to sneeze and cough, and have a serious detrimental effect on the tourist business.

The Bureau is conducting research on predicting the occurrence of red tides, and on methods of control. Gross prediction is now possible as a result of studies of rainfall, land drainage, water movements, and of the numbers and distribution of the organism itself. Through laboratory studies it has been determined that *G. breve* is extremely sensitive to various metals, especially copper. During a recent outbreak, the first large-scale control experiment was made using copper sulphate. This chemical, in a fine granular form, was distributed over the red tide areas by crop dusting airplanes and boats. Results were very promising.

The Florida State Board of Conservation has now taken over the duties of control with copper sulphate. The Bureau is still responsible for research on prediction and methods of control.

ESTUARINE STUDIES

One of the most important problems confronting the Bureau is the effects of engineering projects, land development and reclamation on vast estuarine areas of the Atlantic and gulf coasts which are the nursery grounds for many of our major species. For example, the menhaden and shrimp are totally dependent upon them. It is essential that the effects of changes in the environment be assessed so that proper precautions can be made relative to future engineering projects, etc. to minimize the effects on our fishery resources.

There is now general agreement among State and Federal agencies that there is need for a research program to provide greater knowledge concerning the reaction of shellfisheries, fin-fisheries and water fowl to changes in salinity, temperature, sedimentation, and to pollution as well as other factors introduced by man-made changes. The need for such knowledge was recognized by the Atlantic and Gulf States Marine Fisheries Commissions at their most recent meetings. The Service is now studying ways of setting up a research program and is considering the type of organization which would best fit the needs of the many agencies and groups interested in estuarine changes.

JELLYFISH OR SEA-NETTLE PROBLEM

Each year during the summer, waters along the Atlantic and gulf coasts become infested with jellyfish. These animals are an extensive nuisance, especially in bays and quiet waters used for fishing and swimming, also they have a very serious effect on the tourist business.

We feel that development of control methods can be accomplished only if the details and requirements of each part of the complex life of the animal are known. Reduction or control methods could then be designed on the basis of this knowledge probably attacking each phase of life by chemical, mechanical, or biological means or combinations of these. An extensive research program is needed to produce the detailed knowledge necessary.

In the closing days of the 84th Congress, Senator Butler, of Maryland, introduced a bill which authorized the Service to determine methods of control or extermination of jellyfish and to provide grants to States for such work. The bill was amended to authorize the service to conduct exploratory research on the jellyfish. The amended bill passed the Senate but never became effective because it was not acted upon by the House of Representatives.

DIVISION OF INDIVIDUAL RESEARCH AND SERVICES AS OF NOV. 30, 1957

Total personnel, departmental and field	390
Total permanent, Washington office	92
Total temporary, Washington office	2
Total permanent, field	273
Total temporary, field	23

Project	*Regular, 1958*	*Saltonstall-Kennedy, estimated 1958*
Economics	$48,000	$212,000
Exploratory fishing	375,000	591,500
Market news	300,000	144,400
Statistics	166,000	333,700
Technology	308,000	698,540
Market development		571,500
Special reports		40,000
Construction	300,000	
Total	1,497,000	2,591,640
Total funds available regular and Saltonstall-Kennedy 1958		$4,088,640

Location of field offices and laboratories, Division of Industrial Research and Services

Station location	Branches				
	Exploratory fishing [1]	Technology [2]	Education and Market development	Statistics	Market news
Rockland, Maine				X	
Boothbay Harbor, Maine	X			X	
Portland, Maine				X	
Gloucester, Mass				X	
Boston, Mass	X	X	X		X
New Bedford, Mass				X	
Provincetown, Mass				X	
Providence, R. I				X	
Bayport, N. Y				X	
New York, N. Y			X		X
Toms River, N. J				X	
Annapolis, Md				X	
College Park, Md		X	X		
Weems, Va				X	
Hampton, Va					X
Beaufort, N. C				X	
Charleston, S. C				X	
Brunswick, Ga				X	
Jacksonville, Fla			X		
Miami, Fla	X			X	
Key West, Fla				X	
Fort Meyer, Fla				X	
Tampa, Fla				X	
Apalachicola, Fla				X	
Cedar Point, Ala				X	
Pascagoula, Miss	X	X	X		
Ocean Springs, Miss				X	
Vicksburg, Miss				X	
Northville, Mich				X	
La Crosse, Wis				X	
Lorraine, Ohio			X		
Chicago, Ill					X
Springfield, Ill			X		
New Orleans, La				X	X
Houma, La				X	
Galiano, La				X	
Morgan City, La				X	
Fort Worth, Tex			X		
Galveston, Tex				X	
Freeport, Tex				X	
Aransas Pass, Tex				X	
Brownsville, Tex				X	
Terminal Island, Calif		X	X		
San Pedro, Calif				X	X
Astoria, Oreg				X	
Seattle, Wash	X	X	X	X	X
Ketchikan, Alaska		X	X		
Branch totals	5	6	11	35	7

[1] Fishery Explorations and Gear Research Center.
[2] Technological research laboratories located in these cities.

List of vessels operated for exploratory fishing and gear research

Base	Vessel name
Boothbay Harbor, Maine	Clupea
East Boston, Mass	Delaware
Miami, Fla	George M. Bowers
Pascagoula, Miss	Oregon
Pascagoula, Miss	Silver Bay [1]
Seattle, Wash	John N. Cobb

[1] Vessel *Silver Bay* is retained on bare boat charter agreement for a period of 2 years and is operated and supervised by BCF personnel.

THE UNITED STATES FISHING INDUSTRY

Over one-half million persons are directly or indirectly employed in the United States fishing industry. These persons and their dependents, totaling about 2 million, are affected by the welfare of the industry. They include persons employed in the following activities:

Fishermen	Brokers	Shipyards
Processors	Equipment manufacture	Service trades
Retailers	Wholesalers	
Transporters	Importers	

The annual domestic catch averages nearly 5 billion pounds. In addition, imports derived from foreign catches of approximately 2½ billion pounds are imported into this country each year. The United States is the world's largest importer of fishery products.

Under accepted principles of evaluation among businessmen, the commercial fishery resources of the United States in 1956 were valued at nearly $12 billion.

	Number
Persons employed in the fisheries:	
Fishermen	150,000
Shoreworkers	104,000
Allied industries (gear manufacture, boat building, etc.)	300,000
Total	554,000
Commercial fishing craft:	
Vessels (five net tons and over)	12,250
Motorboats	54,800
Other boats	25,150
Total	92,200

Estimated values of fishery products at various levels, 1956

Level	Value
Producer (fishermen)	$363,000,000
Processor	612,000,000
Wholesaler	865,000,000
Retailer	1,128,000,000

Estimate of capital investment in commercial fisheries, 1596

Item	Accrued value
Producers:	
Fishing craft	$373,766,000
Nets and other gear	74,230,000
Freezing and processing plants	224,379,000
Wholesale fish houses [1]	201,215,000
Retail fish dealers, chainstores, etc.[1]	98,852,000

[1] Capital investment devoted to fish trade.

ECONOMIC PROBLEMS OF THE NEW ENGLAND FISHING INDUSTRY

The economic troubles of the New England fishing industry stem mainly from the fact that its labor costs are higher than those of the foreign countries which export fishery products to this country. This competitive disadvantage has prevailed for a long time but has become much more serious in recent years because of the decline in fish prices.

Many branches of American industry are in a position to meet the challenge of the competition of cheaper foreign labor by the use of efficient modern machinery which reduces drastically labor costs per unit of production. While the New England industry has continually introduced labor-saving devices, there are serious practical limitations upon the possibilities for extensive and rapid reduction of labor requirements because of the very nature of fishing operations.

The problems of the New England industry have been compounded by several other developments. The hard times which have befallen the industry have in themselves discouraged the influx of private capital badly needed for modernization. Furthermore, prices have risen sharply for goods and services used by the industry and particularly such important items for the fishing fleet as the cost of new vessels, marine insurance and shipyard repair services. Subsidies paid by foreign governments to their fishermen and processors have placed the New England industry at further competitive disadvantage.

THE CANNED-SHRIMP PROBLEM

The supply of small shrimp in the central Gulf of Mexico has been unusually small during the current season and canners who are dependent on these shellfish have suffered great hardship. The pack of canned shrimp in the States of Alabama, Mississippi, and Louisiana for the period from August 1 to November 30, 1957, totaled only 195,955 cases, compared with 511,027 cases packed during the same period the previous year.

Normally, over 50 percent of the year's pack of canned shrimp is processed by November 30. If this ratio holds for the 1957–58 season, the total pack for the current year would total about 375,000 cases. This would be the smallest production since records on canning of shrimp first became available in 1921—except for 1945, when conditions caused by World War II limited the canning of these shellfish.

The pack of canned shrimp during the past 3 years averaged 850,000 standard cases.

THE TUNA PROBLEM

The American tuna industry is confronted by major difficulties, mainly the result of increasing import of frozen and canned tuna from Japan. Since 1951, the United States tuna fleet has had a declining market, despite the steadily increasing consumption of canned tuna. Domestic canners, although faced with increased imports of canned tuna, have been able to buy raw materials from either domestic or foreign sources, whichever has been to their advantage.

Over the past 2½ years, domestic landings have been reduced, ex-vessel prices have declined, and the number and capacity of the United States tuna fleet has declined. As a result, earnings of tuna fishermen and opportunities for employment have been reduced.

These adverse trends have largely been caused by (1) increased costs of United States tuna vessel construction and operation; (2) declining prices for domestically produced raw fish and canned tuna, owing to stiff competition pricewise from imports; (3) disparities in the tuna tariff rates; and (4) an increase in the landings of the Japanese tuna fleet, which through Government assistance now produces more than double the prewar annual average and has additional potential.

During 1956, the United States imported 121 million pounds of frozen whole tuna, 38 million pounds of canned tuna, and about 5 million pounds of frozen, cooked tuna loins and disks. Data for 1957 show substantial gains over 1956. The 1956 imports were equivalent to about 223 million pounds, landed weight, compared with a total catch of 350 million pounds for continental United States, Hawaii, and Puerto Rico.

EXPLORATORY FISHING AND GEAR RESEARCH

Plans and conducts exploratory fishing programs to locate and determine the extent of new fishing grounds and the size and character of the resource using specially equipped vessels.

Designs, tests, and develops new types of fishing gear and equipment.

Determines the effectiveness of new and conventional types of fishing gear and fishing craft and demonstrates the most efficient and safe means and methods of operation.

Conducts a consulting service on fishing methods and operations.

The following types of work are being carried out: Shrimp resource exploration off the coasts of Oregon, Washington, and Alaska; basic studies of the mechanics of operation of moving fishing gear with particular reference to shrimp trawls; exploration for deep-water shrimp off the southeastern coasts; experimental trawling for sand eels off the northeastern coast; reconnaissance and test fishing for unutilized sardines and similar fishes of the Gulf of Mexico; red snapper trap development and testing; certification of trawl cod ends as to conformance of mesh size with regulations and concurrent studies of qualities of materials as a service both to fishermen and suppliers; development of a safety program with particular reference to safety on fishing vessels, with a view to the reduction of losses which are a serious problem to the fishing industry.

TECHNOLOGY

This activity involves research and advisory services on the technological problems of the fisheries industry. Research is both of fundamental and applied nature and is programed to meet the needs of the fisheries in the several areas in which the five technological laboratories are located. The advisory services were instituted to combat the natural lag between laboratory developments and commercial application thereof, as well as to bring to the aid of the small boatowner and processor the available technological knowledge through the media of visits, in-plant demonstrations, Government-industry conferences, and correspondence.

The research technologists conduct chemical, bacteriological, nutritional, and engineering research and development studies designed to improve and develop methods of handling, processing, preserving, and distributing of fish and shellfish as well as on the utilization of industrial fish and marine plant products. They also develop information on sanitation measures and requirements for voluntary United States standards of grade and condition of fishery products and participate in implementation through inspection and grading services.

The technologists performing advisory services schedule plant visits in each fishing center and discuss plant problems or bring new procedures to the attention of processors. Follow-up visits are made to discuss status of problems previously answered by correspondence.

The following types of work are being carried out:

Development of standards and specifications for fish and fishery products.
Advisory services to industry.
Preservation and processing of fish and shellfish.
Nutrition and pharmacology of fish and fishery products.
Chemistry and composition of fish and fishery products.
Irradiation-preservation of fish and fishery products.
Development of new uses for fish oils.

MARKET DEVELOPMENT

Develops markets for domestic fishery products through (1) increasing the use of fishery products in school lunch, institutional, and consumer menus; (2) encouraging greater distribution of fish through frozen food centers; (3) special programs of market promotion; (4) forecasting future marketing conditions; (5) developing and expanding foreign markets; and (6) finding new uses for underutilized species.

Conducts an educational service to promote the free flow of fishery products of domestic origin by (1) developing visual and other educational materials, including recipe development and the production and distribution of fishery motion pictures in cooperation with the industry; (2) informing the industry and consumers of new and more efficient methods of production, distribution, and preparation by means of field demonstrations and a consulting service; (3) conducting test kitchen activities and fish cookery demonstrations; and (4) encouraging commercial fishery courses in educational institutions.

Administration of the fishery education bill, Public Law 1024 (84th Cong.), including evaluation of applications for educational grants and periodic review to assure that proper use is being made of the grants in order to most effectively carry out the intent of the act.

Prepares and publishes Commercial Fisheries Abstracts, a monthly summary, in abstract form, of technical items of interest to the commercial fishing industry. Publications appear as Commercial Fisheries Abstracts and Test Kitchen Series.

Motion pictures are distributed through Division of Information, Fish and Wildlife Service, and university and commercial film libraries.

The following types of work are being carried out: Motion pictures on fish cookery; preparation of kitchen-tested recipes, particularly on scallops, sardines, and rockfish; fish cookery demonstrations for school lunch, restaurant, extension service, college and university personnel throughout the United States; market promotional programs; market analysis with preparation and distribution of Commercial Fisheries Outlook (quarterly), preparation of food releases for newspapers, television, radio, and food trade organizations; consulting services regarding education programs at college and vocational levels, educational exhibits at national conventions; market research concerning wholesale, retail, and consumer practices; development of foreign markets for fishery products; and assisting the rough fish industry in locating new markets.

ECONOMICS

Plans and organizes studies and investigations on the economic position of the fishing industry within the national economy. Studies are conducted on production, distribution, and consumption of fishery products; on the economic effect of technological and biological developments in the industry; on price levels, marketing of fishery products and competitive products, and transportation rates and services; and does research on tariff and trade problems. Data is obtained on activities of fishery cooperatives as required to assure their conformity with provisions of the Fishery Cooperative Marketing Act (Public Law 464, 73d Cong.).

Reports are prepared giving the results of these studies and investigations. Consulting services are furnished in economics, cooperative marketing and labor relations.

The following types of work are carried out: A survey of the fishing industry's hull insurance and protection and indemnity insurance problems—a serious matter since phenomenal rises in insurance premiums in many segments of the industry add considerably to vessel operating costs; a survey of safety methods and needs on the fishing vessels, a corollary of the insurance study; vessel efficiency studies; economic analysis of freezing fish at sea; basic factors which affect supply and demand—pricing products to get the greatest amount of profitable sales; interrelationship of biological and economic forces—what effect will a price decline in one fishery have upon another; impact of Government and industry-imposed regulations upon a fishery—a study of the effort to gear halibut landings to the handling capacity of processing facilities; effect of transportation rate increases upon the fishing industry; problems relating to the imports of groundfish fillets and tuna; studying the preferences of household consumers, restaurants, and other food users for fishery products.

MARKET NEWS

Conducts a fishery market news service—the eyes and ears of the fishing industry—for the collection and dissemination of current market information and developments on fishery commodities. This service is operated in important fishing ports and marketing centers in order to encourage the orderly marketing of fishery products and byproducts.

Information is collected, compiled, analyzed, and disseminated daily on landings, receipts, imports, rail and truck movements, cold storage stocks, market conditions, prices, and current trends and developments. Telephone, telegraph, teletype, radio, and daily mimeographed reports, and monthly and annual summaries are used to disseminate the information.

A monthly periodical Commercial Fisheries Review, is prepared and published. It contains current information and trends on domestic and foreign fisheries, and related developments. Issued in addition to the periodical are daily mimeographed Market News Reports, monthly and annual Market News Summaries, and periodic Market News Trend Reports. These are issued from Boston, New York City, Hampton, Va., New Orleans, San Pedro, Calif., Seattle, and Chicago.

Since there is now no single publication that shows the complete status of the fishing industry on a current basis, plans are being finalized to consolidate the mass of raw data available in order to issue up to date periodic summaries on a regional and national basis which will give the current overall status of the fisheries for quick and easy reference. Basic reliable information is recognized as essential in making business management decisions.

Since World War II there has been a shift in the marketing of edible fishery products with more and more emphasis being placed on consumer-packaged products and specialties. Market news coverage is being shifted and broadened to more adequately cover the marketing of the many types of packaged fishery products which have been and are being placed on the market. Adequate, accurate, and reliable information is a necessity for the orderly marketing of fishery products.

STATISTICS

Conducts statistical surveys and collects, analyzes, and disseminates fishery statistics such as volume and value of the catch of each species by types of gear and geographical areas, the quantity of each kind of gear, the number of fishing craft, employment in the fishery industries, the volume and value of processed fishery products, monthly freezings and stocks of frozen fish, monthly production of fish meal and oil, and monthly landings of fishery products in Maine, Massachusetts, Rhode Island, New York, New Jersey, North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Lousiana, Texas, Calfornia, and Ohio.

Prepares and distributes reports resulting from these activities.

Conducts a consulting service on fishery statistics.

Issues annual fishery statistics of the United States (Statistical Digests), monthly and annual bulletins (Current Fishery Statistics Series), and lists of wholesale dealers and manufacturers.

The following types of work are being carried out: Collection of basic employment, operating unit, catch, and manufactured fishery products statistics; and detailed information on the catch of fishery products by vessels in the Northwest Atlantic, and on the shrimp fishery of the South Atlantic and Gulf States.

Preparation of current summaries of the total catch of fishery commodities by regions and species to provide data on production trends.

SPECIAL REPRORTS

Investigations are concluded and reports are prepared and coordinated as requested on (1) foreign and domestic fishery situations, (2) production and flow to market of fishery products of foreign producers which affect domestic fisheries, and (3) competitive position of domestic and foreign-produced fishery products.

Research is conducted and services are provided to the public, to the President, and to the Congress on foreign trade and tariff problems, materials are prepared for trade agreement negotiations, and import and export trends are analyzed in relation to the problem areas.

To prepare reports and provide services on the effects of foreign fisheries on domestic fisheries, a foreign reporting program for fisheries is conducted. Requests for information are coordinated and submitted through the Department of State to foreign posts. The Bureau works closely with the Department of State in processing and evaluating foreign reporting.

The following types of reports are required by the Fish and Wildlife Act of 1956:

Section 5: Periodical reports to the public, the President, and the Congress with respect to the following matters—

(1) The production and flow to market of fish and fishery products domestically produced, and also those produced by foreign producers which affect the domestic fisheries;

(2) The availability and abundance and the biological requirements of the fish and wildlife resources;

(3) The competitive economic position of the various fish and fishery products with respect to each other, and with respect to competitive domestic and foreign-produced commodities;

(4) The collection and dissemination of statistics on commercial and sport fishing;

(5) The improvement of production and marketing practices in regard to commercial species and the conduct of educational and extension services relative to commercial and sport fishing, and wildlife matters;

(6) Any other matters which in the judgment of the Secretary are of public interest in connection with any phases of fish and wildlife operations.

Section 7: Reports to the President, the Congress, and industry involving—

(1) Development and recommendation of measures to assure the maximum sustainable production of fish and fishery products to prevent fluctuations;

(2) Studies of the economic condition of the industry to aid in stabilizing the domestic fisheries;

(3) Development and recommendation of special promotional and informational activities with a view to stimulating the consumption of fishery products.

Section 8: Preparation of reports—

(1) Outlining the departmental position on items of the agenda for international conferences and meetings;

(2) Outlining the departmental position in Trade Agreement negotiations;

(3) For consultation with governmental, private nonprofit, and other organizations and agencies concerned with any phase of the fisheries.

Section 9: Reports on activities and imports as follows:

(1) Annual report to the Congress with respect to the activities of the United States Fish and Wildlife Service under the act with recommendations for additional legislation;

(2) Report to the President and the Congress; to the Tariff Commission, when requested; and upon request from any segment of the domestic industry in regard to the production, employment in production, prices and sales of domestic fishery products and the imports of competitive fishery products.

DIVISION OF RESOURCE MANAGEMENT

1. 1958 Budget

(*a*) Alaska fisheries:		
Research		$170,000
Management and enforcement	$876,955	
Vessels	524,170	
Aircraft	165,425	
Communications	25,725	
		[1] 1,592,275
Construction (laboratory)		400,000
(*b*) Marine mammals:		
Fur-seal management	1,611,000	
Full-seal research	205,500	
whale research	11,300	
		1,827,800
(*c*) Columbia River development:		
Fish facilities	37,000	
Columbia River construction	[2] 1,600,000	
Columbia River operation and maintenance	[2] 1,315,000	
		2,952,000
(*d*) Treaty enforcement:		
Pacific Northwest	44,300	
Northwest Atlantic	19,500	
		63,800
Grand total, all sources (exclusive of $824,670 Saltonstall)		7,005,875

[1] Includes $1,212,900 definite appropriation and $379,375 Pribilof receipts.
[2] Transfers from Corps of Engineers' appropriations.

2. 1958 personnel

	Permanent	Seasonal
(a) Departmental	9	
(b) Field:		
1. Alaska fisheries:		
Research, including SK	34	105
Management	81	282
2. Marine mammals:		
Fur-seal management	215	128
Fur-seal research	11	11
Whale research	1	2
3. Columbia River development:		
Fish facilities	7	
Columbia River construction	2	16
Columbia River operation and maintenance	48	
4. Treaty enforcement:		
Pacific Northwest	1	10
Northwest Atlantic	1	
Total, field	402	554
Grand total, all sources	411	554

3. Administration of Pribilof Islands

(a) Total resident Aleut natives, December 31, 1957—approximately 611.

(b) Total take of sealskins and distribution:

Year	United States	Canada	Total
1950	48,163	12,041	60,204
1951	48,551	12,138	60,689
1952	51,138	12,784	63,922
1953	53,335	13,334	66,669
1954	51,106	12,776	63,882
1955	52,510	13,128	65,638
1956	98,261	24,565	122,826
1957	74,894	18,724	93,618

(c) Total take of Alaska sealskins and United States receipts, by periods:

Period	Sealskins	Net United States receipts
1870–1909 under lease	2,322,473	$8,963,240
1910–11 United States operations	25,102	621,308
1912–41 under 1911 treaty	1,035,767	1,838,816
1942–56 under provisional treaty	1,012,862	20,665,117
Total	4,396,204	32,088,481

(d) Total size of Alaska herd—Approximately 1,500,000 animals.

(e) Total estimated fur-seal pup mortality, St. Paul Island:

Year:	*Dead pup counts* [1]
1941	19,000
1950	54,000
1951	76,300
1953	84,273
1954	100,987
1955	79,321
1956	103,642

[1] Includes 5 percent addition for dead pups missed beginning 1954.

3. Administration of Pribilof Islands—Continued

(*f*) Total pups tagged for research on Pribilof Islands:

Year:	*St. Paul*
1941	10,000
1945	973
1947	19,183
1948	19,532
1949	19,960
1951	1,000
1952	20,000
1953	10,000
1954	10,000
1955	50,000
1956	[2] 50,000

[2] Includes 10,000 tagged on St. George.

Permanent field stations and equipment

Branch of Alaska Fisheries:

Field stations:

Seattle, Wash.
Ketchikan, Alaska
Petersburg, Alaska
Juneau, Alaska
Cordova, Alaska
Anchorage, Alaska
Kodiak, Alaska
King Salmon, Alaska

Seagoing patrol vessels:	*Length in feet*
Auklet II	57
Manning	85
Dennis Winn	148
Kittiwake II	72
Murre	88
Pelican	73
Teal	73
Aircraft:	
Grumman Goose	6
Cessna 180	1
Cessna 170	1
Piper PA–18	1

Branch of Marine Mammals:

Field stations:

Seattle, Wash.
St. Paul Island, Alaska
St. George Island, Alaska

Seagoing vessels: Penguin II, 148 feet in length.

MANAGEMENT OF ALASKA SALMON FISHERIES

The Bureau of Commercial Fisheries is responsible for the administration of the commercial fisheries of Alaska. These fisheries are the dominant factor in the economy of the Territory. Salmon account for more than 90 percent of the value of all Alaska fishery products. A major problem of concern to the Bureau has been the decline in the Alaska salmon fisheries since World War II.

Average annual catch, 1930–39, inclusive, 92.5 million fish.

Average annual catch, 1950–56, inclusive, 44.5 million fish

Causes of the decline include:

1. Increase of fishing intensity—twice as many fishermen, more efficient fishing methods and gear, and the Japanese high-seas fishery.

2. Inadequate research to produce needed management tools, and insufficient personnel to enforce regulations effectively.

3. Unfavorable natural conditions for survival.

A vigorous fishery rehabilitation program was launched in 1954, including the curtailment of fishing effort by 50 percent in some areas, a stepped-up preventive enforcement program, and, more recently, area-licensing of net fishermen to further limit fishing efforts. There has been a fivefold increase in research funds and activities since 1955. Studies are underway in close cooperation with the Department of State to solve the problem posed by the Japanese high-seas fishery on Alaska salmon stocks.

Results of the Bureau's program to date are encouraging. However, the dividends for the most part have been in the form of improved spawning escapements rather than increased catches. The recent initiation of a research program, commensurate with the value of the fisheries, offers the means of greatly improving management and of achieving the production potential of Alaska's primary resource.

ENFORCEMENT OF FISHERY LAWS AND REGULATIONS

Alaska

The Bureau operates a fleet of 9 aircraft, 7 seagoing vessels and numerous small craft, and employs 282 seasonsal personnel in the fishery enforcement program along 10,000 miles of Alaska coastline. This program is concentrated primarily near the mouths of major salmon spawning streams where salmon congregate in their spawning migration and where they are particularly vulnerable to illegal fishing operations. In the Territory the enforcement program is closely integrated with the Bureau's fishery management program.

Pacific Northwest

The Bureau is responsible for enforcing laws and regulations implementing the provisions of various fishery treaties to which the United States is a party. In the North Pacific such control measures are enforced by the Bureau with respect to Fraser River pink and sockeye salmon, halibut, fur seals, and whales. Here, too, the Bureau enforces regulations governing offshore fishing by United States nationals. The total budget for this program is $44,300 which cover 1 full-time agent, 10 seasonsal agents, and operation of a 34-foot patrol boat. The Coast Guard assists wherever possible in offshore patrol. A seagoing patrol boat is needed by the Bureau to cope with increasing enforcement responsibilities.

New England

The cod and haddock fisheries of the northwest Atlantic are coming increasingly under the protection of regulatory measures recommended by the International Northwest Atlantic Fisheries Treaty agency, of which the United States is a member. At present the Bureau has only a token enforcement organization in this area, limited to 2 full-time agents operating with a budget of $19,500.

COLUMBIA RIVER FISHERIES DEVELOPMENT PROGRAM

Civilization has severely handicapped the salmon runs of the Columbia River through the construction of dams and irrigation developments, by deforestation, and by pollution. And yet today, with the aid of hatcheries to supplement natural propagation, fishways around dams and other barriers, improvement of streams, and the installation of screens on water diversions, the salmon and steelhead runs of this great river currently are valued at $17 million annually.

The Columbia River fisheries development program is a cooperative enterprise of the fishery agencies of Washington, Oregon, Idaho, and the Bureau of Commercial Fisheries. Funds for this purpose are appropriated by Congress to the Corps of Engineers to mitigate damage to the fisheries from multiple-use water projects. Such funds are then transferred to the Bureau to finance projects of the States and the Bureau. The construction portion of this program was begun in 1949 and is scheduled for completion in 1964.

The total construction cost is estimated to be about $25 million, of which $15 million has been appropriated through fiscal 1958. Projects completed to date include the construction or rehabilitation of 20 hatcheries, and the installation of 500 fish screens.

Over a period of the past 20 years improvement in the early spring chinook runs have been more than offset by declines in the late season runs. The commercial production of salmon averaged 19,566,000 pounds from 1937 to 1946, and 13,210,000 pounds from 1947 to 1956.

MANAGEMENT OF ALASKA FUR-SEAL HERD

Size of herd and annual harvest.—The Alaska fur-seal herd, which numbered only 130,000 animals in 1911, has been restored to its present strength of about 1½ million under the protection of treaties and through the rational management program of the United States Government. In this interval of 45 years more than 2 million skins have been harvested from 3- and 4-year-old male fur seals surplus to the breeding requirements of this highly polygamous species.

An average of 65,000 skins, valued at $6 million, has been taken annually in recent years.

International protection.—On February 9, 1957, the Governments of Canada, Japan, the U. S. S. R., and the United States signed an interim convention for the conservation of the North Pacific fur seals. The stated objective of this treaty is to achieve the maximum sustainable productivity of these resources with due regard for other living marine resources. This objective is to be realized through the coordination of research plans and the review of fur-seal management programs by a North Pacific Fur-Seal Commission. That commission is scheduled to hold its first meeting in Washington, D. C., beginning January 13.

Research.—As a result of recent studies the research staff of the Bureau of Commercial Fisheries has concluded that the Alaska fur-seal herd has reached or is very near its maximum level of development. A very high pup mortality rate and a reduced rate of productivity for the adult females, are important factors contributing to the existing population balance. The research staff has calculated that a herd approximately 15 percent smaller than at present would produce on a sustained-yield basis 60,000 males and 30,000 females. The current management of the Bureau is designed to test this thesis.

SALTONSTALL-KENNEDY ACT

(Passed by 83d Congress, 2d session, and approved July 1, 1954)

Makes available 30 percent of duties on imported fishery products for the conduct of technological, biological, marketing and other research and services (1) to promote the free flow of domestically produced fishery products in commerce and (2) to develop increased markets for fishery products of domestic origin.

Act limited annual expenditures to $3 million and provided for accrual of balances to a maximum of $5 million. Section 12 of Fish and Wildlife Act of 1956 made S-K Act permanent, removed limitation on annual expenditures, and made accrued amounts available until expended.

Amounts available (30 percent of duties) by fiscal year as follows:

1955	$4,207,826
1956	4,321,403
1957	4,359,115
1958	4,651,151
1959	[1] 4,800,000

[1] Estimated.

In fiscal 1958 we have allocated for:

Biological research	$2,679,070
Technological research	1,290,040
Marketing research and services	1,301,600
Administrative costs	(285,000)
Total	$5,525,710

As authorized by the act, Secretary has appointed an advisory committee of 19 members, who represent a complete cross section of the American fishing industry geographically, functionally, and commoditywise.

S–K allocations, fiscal year 1955–58

	Fiscal year 1955	Fiscal year 1956	Fiscal year 1957	Fiscal year 1958
Biological research	$1,464,500	$1,385,000	$3,394,000	$2,679,070
Technological research	760,400	763,000	1,603,000	1,290,040
Marketing research and services	683,600	663,000	1,211,000	1,301,600
(Administrative costs)	91,500	189,000	387,000	285,000
Total	3,000,000	3,000,000	6,595,000	5,525,710

S–K CONTRACTS

Total 3 years, $4,062,215 in 126 contracts with 70 organizations.
Of 70 organizations:
45 are State educational or research organizations.
20 are private research organizations.
3 are Federal agencies.
2 are industry associations.
Of 126 contracts:
57 are in technology for quality improvement, standards development, new uses, and applied research.
20 are in consumption and marketing studies.
36 are in biology of various species, meteorology, and oceanography.
13 are in education and training films and exhibits, fishery exploration, and gear research.

Fiscal year 1955–57

	Fiscal year 1955		Fiscal year 1956		Fiscal year 1957		3 years	
	Number	Value	Number	Value	Number	Value	Number	Value
Biological research	14	$572,580	5	$173,000	17	$1,480,400	36	$2,225,980
Technological research	21	302,940	17	277,260	21	428,339	59	1,008,539
Marketing research and services	16	460,280	6	89,916	9	277,500	31	827,696
Total	51	1,335,800	28	540,176	47	2,186,239	126	4,062,215
Percent of program funds		45.9		19.2		35.2		34.1
Program funds		$2,908,500		$2,811,000		$6,208,000		$11,927,500

S–K ACTIVITIES

Some major accomplishments

1. Initiated voluntary standards of quality for fishery products which have met ready acceptance by industry.
2. New uses for fish oils in the leather tanning process, and as a fungicide and insecticide.
3. Discovered the mechanism of discoloration in canned tuna which has been a problem for over 20 years. A method of prevention of discoloration is being tested on a commercial scale.
4. Discovered new shrimp fishing grounds off the Alaska peninsula which are being utilized commercially.
5. Defined the yellowfin tuna distribution in the Gulf of Mexico based upon which a tuna industry is being established.
6. Discovered royal red shrimp grounds off South Atlantic coast. Commercial operations are underway.
7. Developed successful methods for hatching channel catfish in commercial quantities for future use in rice paddies and other inland waters.
8. Developed successful method for color-dying shrimp as a means of identification in population studies.
9. Developed towers for counting upstream migrating adult red salmon to replace very expensive weir or picket fence structures which also hampered salmon to some degree.
10. Established index of abundance of downstream migrating pink salmon as a means of predicting for the industry the size of the returning adult runs.
11. Developed means of identifying North American and Asian salmon taken on the high seas to aid in determining location fo a line to aid in equitable division of catch among the United States, Japan and Canada.
12. Developed two new methods for oyster drill control to aid the industry in combating these predators which destroy oysters.
13. Isolated and demonstrated value of oyster food organisms leading toward artificial propagation of oysters on a commercial scale to make up for the deficiency resulting from poor sets in recent years.

14. Developed information on fishing vessel insurance problems which point the way to reduce costs of operation through reduction of insurance costs.
15. Revealed areas of underconsumption for certain canned fishery products. This shows the industry where sales efforts might be concentrated.
16. Assisted industry in moving oversupplies of haddock fillets and canned tuna through intensive market promotion campaigns.
17. Developed a rapid and objective laboratory test of nutritive quality of fishmeal, which is now being tested on a commercial scale.
18. Improved quality of fish landed by fishermen through direct demonstrations of proper handling methods under commercial conditions at sea.
19. Successfully screened a wide variety of fishery products capable of being preserved for food by nuclear radiations.
20. Assembled first authoritative tabulations of chemical composition of many species of fish and shellfish for use by industry in marketing and for dietitians and other food specialists.
21. Conducted fish cookery demonstrations for about 20,000 supervisory school-lunch personnel serving about 12 million schoolchildren each day and representing about 2½ million pounds of fish (edible weight) per week.
22. Developed greater markets for fishery products through the 10,000 frozen-food locker plants in the United States.
23. Produced six color sound motion pictures—financed by industry—designed to increase markets for fishery products.
24. Developed preliminary design plans for a modern freezing-at-sea trawler for industry of northwest Atlantic for quality improvement and more efficient and economical operation.
25. Developed a practical electrical telemetering device with which fishermen can readily determine depth at which their midwater trawl nets are fishing.
26. Successfully demonstrated practicability of midwater trawling gear. It will now be possible to develop fisheries in offshore areas not now utilized.
27. Developed a complete anatomical atlas, for the first time, on the white shrimp as an important step in management research.
28. Developed a management plan for rehabilitation of the sponge resources.
29. Defined northern distribution of albacore off the Pacific coast of the United States and demonstrated that albacore can be successfully harvested by gill netting.

Estimated Saltonstall-Kennedy funds available, fiscal year 1959

Transferred from Department of Agriculture under the act	[1] $4,800,000
Balance from previous years (see below for detail)	306,826
Total available July 1, 1958	[1] 5,106,826

[1] Estimated.

Saltonstall-Kennedy funds balances

	Fiscal, 1955	Fiscal, 1956	Fiscal, 1957	Fiscal, 1958
Transferred from Department of Agriculture under the act	$4,207,826	$4,321,403	$4,359,115	$4,651,151
Balances from previous years		1,304,179	2,655,084	1,211,385
Total funds available	4,207,826	5,625,582	7,014,199	5,862,536
Allocated for carrying out purposes of the act [1]	3,000,000	3,000,000	6,595,000	5,584,070
Balance for accrual	1,207,826	2,625,582	419,199	278,466
Unobligated	96,353	29,502	[2] 792,186	[2] 28,360
Balance at end of year	1,304,179	2,655,084	1,211,385	306,826

[1] Beginning with fiscal 1957, the $3,000,000 annual limitation was removed by the Fish and Wildlife Act of 1956.
[2] As of June 30, 1957, includes $424,070 reallocated for 1958.
[3] Originally shown as a reserve in the tabulation of the fiscal year 1958 program.

Programs and allocations under Saltonstall-Kennedy Act, fiscal year 1958

	Fiscal year 1958, allocations approved Aug. 1, 1957	Additional allocations requested	Revised, fiscal year 1958 program
I. Research on fish and fisheries (fishery biological studies):			
A. Coastal and offshore fishery research:			
1. Alaska salmon and ecologically related species:			
(*a*) Development of methods of counting and recording escapement	$135,400	$12,000	$147,400
(*b*) Studies of migrations, and of predators, effects of logging, and other environmental factors	262,800	61,000	323,800
(*c*) Development of methods for more accurate predictions of runs	160,900	.....	160,900
(*d*) Analysis of accumulated fishery and research data	42,500	.....	42,500
(*e*) Identification of Pacific herring populations and development of methods of predicting abundance	85,000	5,000	90,000
(*f*) Fishery surveys of Alaska rivers north of Bristol Bay	24,000	.....	24,000
2. Pacific sardine: A cooperative program of research on fluctuation in abundance of Pacific sardine, anchovy, and mackerel	116,350	.....	116,350
3. Ocean research: Research on the Pacific Ocean to assemble data on climate and oceanography in order to determine relationship between environment and worldwide fluctuations of the commercially valuable species of fishes	45,050	.....	45,050
4. North Atlantic trawl fishes: To secure information on biology of sea scallop, flounders, whitings, advance studies of ocean perch	340,800	80,000	420,800
5. Studies on biology of Atlantic herring (sardines)	102,000	.....	102,000
6. Gulf of Mexico fishes:			
(*a*) Study of causes and control of toxic red tide in Florida coast	115,500	.....	115,500
(*b*) Research on shrimp nursery grounds and shrimp movements	134,500	.....	134,500
(*c*) Improvement of facilities	30,000	.....	30,000
(*d*) Sampling shrimp at sea in Tortugas fishery	25,000	35,000	60,000
7. Atlantic striped bass research: Study of races, oceanic migration, variations in year class strength, effect of fishing, and evaluation of productivity of different ages and sizes	43,600	17,000	60,600
8. Manhaden research:			
(*a*) Research on population, age, and distribution of Atlantic menhaden	83,000	.....	83,000
(*b*) Research on population, age, and distribution of Gulf of Mexico menhaden	.....	.....	.....
9. North Pacific oceanic fisheries	100,750	.....	100,750
10. Studies on biology of Alaska king crab	28,070	8,000	36,070
11. Hydrography, occurrence and abundance of fishes, Atlantic coast	.....	16,000	16,000
12. Interagency coordination of hydrographic research	.....	10,000	10,000
13. Coordination of Saltonstall-Kennedy Act programs in southern California	.....	25,000	25,000
Total, coastal and offshore fishery research	1,875,220	269,000	2,144,220
B. Commercial shellfishery research:			
1. To intensify research on predators, dependable seed oyster supply, and quality of marketable oysters from different areas by strengthening research personnel and facilities at existing laboratories:			
(*a*) New England oysters	26,500	.....	26,500
(*b*) Middle Atlantic oysters	103,100	11,000	114,100
(*c*) Gulf of Mexico oysters	26,300	.....	26,300
2. Research on biology of Atlantic blue crab	.....	.....	.....
Total, commercial shellfishery research	155,900	11,000	166,900
C. Pacific oceanic fisheries investigations: To provide additional research on albacore tuna, to define location of stocks in waters north of Hawaii	230,350	.....	230,350
D. Contract research on tuna	.....	.....	.....
E. Inland commercial fisheries:			
1. Commercial fish propagation	25,700	.....	25,700
2. Great Lakes fisheries research	91,900	20,000	111,900
Total, inland commercial fisheries	117,600	20,000	137,600
Total, research on fish and fisheries (fishery biological studies)	2,379,070	300,000	2,679,070

Programs and allocations under Saltonstall-Kennedy Act, fiscal year 1958—Con.

	Fiscal year 1958, allocations approved Aug. 1, 1957	Additional allocations requested	Revised, fiscal year 1958 program
II. Exploration, development, and utilization of fishery resources (commercial fishery studies):			
A. Exploratory fishing and gear research:			
1. Maine sardine exploration, in cooperation with biological studies	$78,000		$78,000
2. North Atlantic explorations: Operation of vessel *Delaware*—to explore new fishing grounds	199,000		199,000
3. South Atlantic and gulf explorations: Off-shore shrimp exploration to determine commercial potentialities	91,000		91,000
4. Gear development and improvement	119,500	$40,000	159,500
5. Maintenance of vessels			
6. Studies to provide insurance rate reduction through vessel safety program	35,000		35,000
7. Experimental gulf tuna longline fishing to evaluate typical commercial operation	29,000		29,000
Total, exploratory fishing and gear research	551,500	40,000	591,500
B. Fishery technological studies:			
1. Middle Atlantic and gulf research:			
(*a*) Research to develop proper methods for handling, freezing, and packaging southern oysters in gulf and South Atlantic areas	17,000		17,000
(*b*) Gulf of Mexico technological program	33,000		33,000
2. Development of voluntary standards: Research to develop voluntary Federal grades and standards for various fishery products	185,160	40,000	225,160
3. Development of chemical index for nutritive value of fish meal: Research to develop more rapid and better means of evaluating the nutritive properties of fish meal	95,900		95,900
4. Development of new uses for fish oil: Research to find new specific uses for fish oils for a favorable competitive status against existing surplus of domestic fats and oils	204,880	15,000	219,880
5. Improvement in quality of tuna: Study to improve methods of freezing skipjack tuna at sea and to improve tuna quality throughout the processing stages	62,600		62,600
6. Preservation of fishery products by irradiation			
7. Studies to develop new uses for Pacific Coast rockfish	20,000		20,000
8. Studies to increase use of Great Lakes herring	25,000		25,000
Total, fishery technological studies	643,540	55,000	698,540
C. Commercial fishery statistics:			
1. Expediting release of statistics to meet requirements of other Saltonstall-Kennedy Act projects and industry, States, and Federal needs	303,700		303,700
2. Statistical survey of Gulf bait shrimp industry	30,000		30,000
Total commercial fishery statistics	333,700		333,700
D. Commercial fishery economic studies: For studies, especially on fish consumption, economic surveys of certain segments of the fishing industry, and for cooperative marketing studies	198,000	14,000	212,000
E. Fishery education and market development:			
1. For promoting the use of domestically produced fishery products through educational services and market development activities, particularly school lunch, locker plant and special marketing programs, and foreign industry studies, as required. (The listed allocations include $175,000 which was transferred annually for educational and market development activities prior to enactment of the Saltonstall-Kennedy Act)	406,500	10,000	416,500
2. Marketing studies to determine basic marketing patterns	155,000		155,000
Total, fishery education and market development	561,500	10,000	571,500
F. Market news: Improving market news coverage to meet requirements of other Saltonstall-Kennedy Act programs and industry, State, and Federal needs	119,400	25,000	144,400
G. Special reports on tariff, trade, legislation, International Law Commission, and as required by Fish and Wildlife Act of 1956	40,000		40,000
Total, exploration, development, and utilization of fishery resources (commercial fishery studies)	2,447,640	144,000	2,591,640

Programs and allocations under Saltonstall-Kennedy Act, fiscal year 1958—Con.

	Fiscal year 1958, allocations approved Aug. 1, 1957	Additional allocations requested	Revised, fiscal year 1958 program
III. Administrative expenses:			
1. Assessment for general administrative services	$270,000	----------	$270,000
2. Advisory committee expenses	15,000	----------	15,000
Total, administrative expenses	285,000	----------	285,000
IV. Reserve	28,360	----------	28,360
Total programs	5,140,070	$444,000	5,584,070
RECAPITULATION			
I. Research on fish and fisheries	2,379,070	300,000	2,679,070
II. Exploration, development, and utilization of fishery resources	2,447,640	144,000	2,591,640
III. Administrative expenses	285,000	----------	285,000
IV. Reserve	28,360	----------	28,360
Total	5,140,070	444,000	5,584,070

[Public Law 1024—84th Congress]

[Chapter 1036—2d Session]

S. 3275

AN ACT

To establish a sound and comprehensive national policy with respect to fish and wildlife; to strengthen the fish and wildlife segments of the national economy; to establish within the Department of the Interior the position of Assistant Secretary for Fish and Wildlife; to establish a United States Fish and Wildlife Service; and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this Act may be cited as the "Fish and Wildlife Act of 1956".

DECLARATION OF POLICY

SEC. 2. The Congress hereby declares that the fish, shellfish, and wildlife resources of the Nation make a material contribution to our national economy and food supply, as well as a material contribution to the health, recreation, and well-being of our citizens; that such resources are a living, renewable form of national wealth that is capable of being maintained and greatly increased with proper management, but equally capable of destruction if neglected or unwisely exploited; that such resources afford outdoor recreation throughout the Nation and provide employment, directly or indirectly, to a substantial number of citizens; that the fishing industries strengthen the defense of the United States through the provision of a trained seafaring citizenry and action-ready fleets of seaworthy vessels; that the training and sport afforded by fish and wildlife resources strengthen the national defense by contributing to the general health and physical fitness of millions of citizens; and that properly developed, such fish and wildlife resources are capable of steadily increasing these valuable contributions to the life of the Nation.

The Congress further declares that the fishing industry, in its several branches, can prosper and thus fulfill its proper function in national life only if certain fundamental needs are satisfied by means that are consistent with the public interest and in accord with constitutional functions of governments. Among these needs are:

(1) Freedom of enterprise—freedom to develop new areas, methods, products, and markets in accordance with sound economic principles, as well as freedom from unnecessary administrative or legal restrictions that unreasonably conflict with or ignore economic needs;

(2) Protection of opportunity—maintenance of an economic atmosphere in which domestic production and processing can prosper; protection from subsidized competing products; protection of opportunity to fish on the high seas in accordance with international law;

(3) Assistance—assistance consistent with that provided by the Government for industry generally, such as is involved in promoting good industrial relations, fair trade standards, harmonious labor relations, better health standards and sanitation; and including, but not limited to—

(a) services to provide current information on production and trade, market promotion and development, and an extension service,

(b) research services for economic and technologic development and resource conservation, and

(c) resource management to assure the maximum sustainable production for the fisheries.

The Congress further declares that the provisions of this Act are necessary in order to accomplish the objective of proper resource development, and that this Act shall be administered with due regard to the inherent right of every citizen and resident of the United States to engage in fishing for his own pleasure, enjoyment, and betterment, and with the intent of maintaining and increasing the public opportunities for recreational use of our fish and wildlife resources, and stimulating the development of a strong, prosperous, and thriving fishery and fish processing industry.

REORGANIZATION WITHIN THE DEPARTMENT OF THE INTERIOR

SEC. 3. (a) There is hereby established within the Department of the Interior the position of Assistant Secretary for Fish and Wildlife, and the position of Commissioner of Fish and Wildlife. Such Assistant Secretary shall be appointed by the President, by and with the advice and consent of the Senate, and shall be compensated at the same rate as other Assistant Secretaries. The Commissioner shall be appointed by the President by and with the advice and consent of the Senate. He shall receive compensation at the same rate as that provided for Grade GS–18. There is also established a United States Fish and Wildlife Service within the Department, consisting of two separate agencies, each of which shall have the status of a Federal bureau. There shall be a Director of each of said Bureaus appointed by the Secretary at Grades GS–17 each. One of the agencies shall be known as the "Bureau of Commercial Fisheries" and the other agency shall be known as the "Bureau of Sport Fisheries and Wildlife." The United States Fish and Wildlife Service, except as prescribed by this Act, shall succeed to and replace the presently existing Fish and Wildlife Service of the Department.

(b) The functions of the United States Fish and Wildlife Service hereby established shall be administered under the supervision of the said Commissioner of Fish and Wildlife, who shall be subject to the supervision of the Assistant Secretary for Fish and Wildlife.

(c) All functions and responsibilities placed in the Department of the Interior or any official thereof by this Act shall be included among the functions and responsibilities of the Secretary of the Interior, as the head of the Department, and shall be carried out under his direction pursuant to such procedures or delegations of authority as he may deem advisable and in the public interest.

(d) In order to make a proper distribution between the two Bureaus of the United States Fish and Wildlife Service established by this Act, the previously existing functions, powers, duties, authority, liabilities, commitments, personnel, records, and other properties or matters previously handled by or administered through the former Fish and Wildlife Service of the Department, shall be distributed as follows:

(1) The Bureau of Commercial Fisheries shall be responsible for those matters to which this Act applies relating primarily to commercial fisheries, whales, seals, and sea-lions, and related matters;

(2) The Bureaus of Sports Fisheries and Wildlife shall be responsible for those matters to which this Act applies relating primarily to migratory birds, game management, wildlife refuges, sport fisheries, sea mammals (except whales, seals and sea-lions), and related matters; and the funds and allocations, appropriated or otherwise, relating to the matters covered by paragraphs (1) and (2) of this subsection shall be distributed between such Bureaus as the Secretary of the Interior shall determine.

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(e) Except as changed by the terms of this Act or by subsequent laws or regulations, all laws and regulations now in effect relating to matters heretofore administered by the Department of the Interior through the former Fish and Wildlife Service as heretofore existing, shall remain in effect.

(f) In recognition of the need for authority to execute the purposes of this Act effectively, the Secretary of the Interior shall exercise such general administrative authority consistently with the terms of this Act as he shall find to be necessary to carry out the provisions of this Act effectively and in the public interest. In order to allow sufficient time to place the reorganizations under this Act into effect, the Secretary is authorized to establish an effective procedure and date of such reorganizations, notice of which shall be published in the Federal Register. Such reorganization shall be accomplished as soon as practicable after the approval of this Act, but not later than ninety (90) calendar days after such approval.

LOAN PROCEDURES

SEC. 4 (a) The Secretary is authorized under rules and regulations and under terms and conditions prescribed by him, to make loans for financing and refinancing of operations, maintenance, replacement, repair, and equipment of fishing gear and vessels, and for research into the basic problems of fisheries.

(b) Any loans made under the provisions of this section shall be subject to the following restrictions:

(1) Bear an interest rate of not less than 3 per centum per annum;

(2) Mature in not more than ten years;

(3) No financial assistance shall be extended pursuant to this section unless reasonable financial assistance applied for is not otherwise available on reasonable terms.

(c) There is hereby created a fisheries loan fund, which shall be used by the Secretary as a revolving fund to make loans for financing and refinancing under this section. Any funds received by the Secretary on or before June 30, 1965, in payment of principal or interest on any loans so made, shall be deposited in the fund and be available for making additional loans under this section. Any funds so received after June 30, 1965, and any balance remaining in the fund at the close of June 30, 1965 (at which time the fund shall cease to exist), shall be covered into the Treasury as miscellaneous receipts. There are hereby authorized to be appropriated to the fund the sum of $10,000,000 to provide initial capital.

(d) The Secretary, subject to the specific limitations in this section, may consent to the modification, with respect to the rate of interest, time of payment of any installment of principal, or security, of any loan contract to which he is a party.

INVESTIGATIONS, INFORMATION, REPORTS

SEC. 5. (a) The Secretary shall conduct continuing investigations, prepare and disseminate information, and make periodical reports to the public, to the President, and to Congress, with respect to the following matters:

(1) The production and flow to market of fish and fishery products domestically produced, and also those produced by foreign producers which affect the domestic fisheries;

(2) The availability and abundance and the biological requirements of the fish and wildlife resources;

(3) The competitive economic position of the various fish and fishery products with respect to each other, and with respect to competitive domestic and foreign-produced commodities;

(4) The collection and dissemination of statistics on commercial and sport fishing;

(5) The collection and dissemination of statistics on the nature and availability of wildlife, progress in acquisition of additional refuges and measures being taken to foster a coordinated program to encourage and develop wildlife values;

(6) The improvement of production and marketing practices in regard to commercial species and the conduct of educational and extension services relative to commercial and sport fishing, and wildlife matters;

(7) Any other matters which in the judgment of the Secretary are of public interest in connection with any phases of fish and wildlife operations.

TRANSFER OF FUNCTIONS—ASSISTANCE OF OTHER AGENCIES

SEC. 6. (a) There shall be transferred to the Secretary all functions of the Secretary of Agriculture, the Secretary of Commerce, and the head of any other department or agency, as determined by the Director of the Bureau of the Budget to relate primarily to the development, advancement, management, conservation, and protection of commercial fisheries; but nothing in this section shall be construed to modify the authority of the Department of State of the Secretary of State to negotiate or enter into any international agreements, or conventions with respect to the development, management, or protection of any fisheries and wildlife resources or with respect to international commissions operating under conventions to which the United States is a party.

(b) There shall be transferred to the Department of the Interior so much of the personnel, property, facilities, records, and unexpended balances of appropriations, allocations, and other funds (available or to be made available) as the Director of the Bureau of the Budget determines to be necessary in connection with the exercise of any functions transferred to the Secretary pursuant to subsection (a) of this section.

(c) The Secretary may request and secure the advice or assistance of any department or agency of the Government in carrying out the provisions of this Act, and any such department or agency which furnishes advice or assistance to the Secretary may expend its own funds for such purposes, with or without reimbursement from the Secretary as may be agreed upon between the Secretary and the department or agency.

POLICIES, PROCEDURES, RECOMMENDATIONS

SEC. 7. (a) The Secretary of the Interior, with such advice and assistance as he may require from the Assistant Secretary for Fish and Wildlife, shall consider and determine the policies and procedures that are necessary and desirable in carrying out efficiently and in the public interest the laws relating to fish and wildlife. The Secretary, with the assistance of the departmental staff herein authorized, shall—

(1) develop and recommend measures which are appropriate to assure the maximum sustainable production of fish and fishery products and to prevent unnecessary and excessive fluctuations in such production;

(2) study the economic condition of the industry, and whenever he determines that any segment of the domestic fisheries has been seriously disturbed either by wide fluctuation in the abundance of the resource supporting it, or by unstable market or fishing conditions or due to any other factors he shall make such recommendations to the President and the Congress as he deems appropriate to aid in stabilizing the domestic fisheries;

(3) develop and recommend special promotional and informational activities with a view to stimulating the consumption of fishery products whenever he determines that there is a prospective or actual surplus of such products;

(4) take such steps as may be required for the development, advancement, management, conservation, and protection of the fisheries resources; and

(5) take such steps as may be required for the development, management, advancement, conservation and protection of wildlife resources through research, acquisition of refuge lands, development of existing facilities, and other means.

STATE DEPARTMENT—COOPERATION

SEC. 8. (a) The Secretary shall cooperate to the fullest practicable extent with the Secretary of State in providing representation at all meetings and conferences relating to fish and wildlife in which representatives of the United States and foreign countries participate.

The Secretary of State shall designate the Secretary of the Interior or the Assistant Secretary for Fish and Wildlife, or a person designated by the Secretary of the Interior to represent the Department of the Interior, as a member of the United States delegation attending such meetings and conferences and also as a member of the negotiating team of any such delegation.

(b) The Secretary of State and all other officials having responsibilities in the fields of technical and economic aid to foreign nations shall consult with the

Secretary in all cases in which the interests of fish and wildlife are involved, with a view to assuring that such interests are adequately represented at all times.

(c) Notwithstanding any other provision of law, the Secretary shall be represented in all international negotiations conducted by the United States pursuant to section 350 of the Tariff Act of 1930, as amended, in any case in which fish products are directly affected by such negotiations.

(d) The Secretary shall consult periodically with the various governmental, private nonprofit, and other organizations and agencies which have to do with any phase of fish and wildlife with respect to any problems that may arise in connection with such fish and wildlife.

REPORTS ON ACTIVITIES AND IMPORTS

SEC. 9. (a) The Secretary of the Interior shall make an annual report to the Congress with respect to activities of the United States Fish and Wildlife Service under this Act, and shall make such recommendations for additional legislation as he deems necessary.

(b) The Secretary is authorized to make a report to the President and the Congress, and, when requested by the United States Tariff Commission in connection with section 7 of the Trade Agreements Extension Act of 1951, as amended (67 Stat. 72, 74), or when an investigation is made under the Tariff Act of 1930 (19 U. S. C. 1332), the Secretary is authorized to make a report to such Commission, concerning the following matters with respect to any fishery product which is imported into the United States, or such reports may be made upon a request from any segment of the domestic industry producing a like or directly competitive product—

(1) whether there has been a downward trend in the production, employment in the production, or prices, or a decline in the sales, of the like or directly competitive product by the domestic industry; and

(2) whether there has been an increase in the imports of the fishery products into the United States, either actual or relative to the production of the like or directly competitive product produced by the domestic industry.

THE RIGHTS OF STATES

SEC. 10. Nothing in this Act shall be construed (1) to interfere in any manner with the rights of any State under the Submerged Lands Act (Public Law 31, Eighty-third Congress) or otherwise provided by law, or to supersede any regulatory authority over fisheries exercised by the States either individually or under interstate compacts; or (2) to interfere in any manner with the authority exercised by any International Commission established under any treaty or convention to which the United States is a party.

AUTHORIZATION FOR APPROPRIATIONS

SEC. 11. There are hereby authorized to be appropriated such sums as may be necessary to carry out the provisions of this Act.

SEC. 12. (a) The authorization for the transfer of certain funds from the Secretary of Agriculture to the Secretary of the Interior and their maintenance in a separate fund as contained in section 2 (a) of the Act of August 11, 1939, as amended July 1, 1954 (68 Stat. 376), shall be continued for the year ending June 30, 1957, and each year thereafter.

(b) Subsection (e) of section 2 of the aforesaid Act of August 11, 1939, as amended, is hereby amended to read as follows:

"(e) The separate fund created for the use of the Secretary of the Interior under section 2 (a) of this Act and the annual accruals thereto shall be available for each year hereafter until expended by the Secretary."

Approved August 8, 1956.

Bureau of Commercial Fisheries, contracts negotiated with Saltonstall-Kennedy Act funds

	Fiscal 1955	Fiscal 1956	Fiscal 1957	Fiscal 1958
Research on methods of handling, freezing, and packaging southern oysters:				
Louisiana State University	$10,000	$10,000	$10,000	
Tulane University	7,600	7,600	15,125	
Florida State University	12,400	13,100	15,055	
University of Maryland				$10,700
Total	30,000	30,700	40,180	10,700
Development of voluntary standards:				
National Fisheries Institute	30,000	55,000	55,000	55,000
University of Washington	9,785	10,000	10,000	18,800
Massachusetts Institute of Technology	15,900	15,000		
California Department of Fish and Game	10,000			
University of Massachusetts	14,898			
University of Florida	6,000			
Philip R. Parks Foundation, San Pedro, Calif		8,000	10,000	18,840
University of Maryland			75,000	
University of Miami		19,900		
Total	86,583	107,900	150,000	91,840
Quality index for fish meal and new uses for fish oils:				
Maryland State College	5,800			
University of Minnesota	53,832	48,900	49,000	
University of Delaware	44,690	25,000	10,009	
North Carolina State	9,700	13,500	10,000	16,400
Texas A. and M	5,900			
University of Cincinnati	16,000	10,000	20,000	
Florida Southern College	5,240	5,400	6,000	
University of Connecticut	8,000			
University of Southern California	6,820			
Oregon State College	7,375			
Arthur D. Little Co., Boston	16,500			
Reedville Oil & Guano Co., Reedville, Va	6,500			
University of California		20,900	30,000	
University of Wisconsin		5,000	5,000	
Alaska Fisheries Experimental Commission		6,000		
University of Massachusetts		3,960		
Total	186,357	138,660	130,009	16,400
Radiation preservation:				
University of Maryland			15,000	
Oregon State College			13,000	
Massachusetts Institute of Technology			24,950	
Food, Chemical, and Research Laboratory, Seattle			13,000	
Florida State University			14,200	
Total			80,150	
Surveys on fish consumption, marketing, etc.:				
University of Miami	12,000			18,985
Federal Trade Commission	9,600	7,416		
Harwell, Knowles & Associates, Inc., Coral Gables, Fla	6,226			
First Research Corp., Inc., Miami, Fla	18,700			
A. C. Nielsen Co., Chicago, Ill	13,784			
Bureau of the Census	40,400	11,500		
Northeastern University, Boston	15,720			
Boston University	70,000			
Oregon State College	49,950			
A. J. Wood & Co., Philadelphia	24,950			
University of Miami (Marine Laboratory)	14,000	20,500		
Department of Agriculture		3,000		
W. R. Simmons & Associates, Inc., N. Y		22,500	3,600	
Boston College		25,000		
University of Washington		25,000		39,700
Maine Department of Sea and Shore Fisheries				25,000
Rutgers University, New Jersey				29,700
In process (basic marketing patterns, 2 to 3 years)				150,000
Total	275,330	89,916	3,600	263,385
Biology of shrimp:				
Tulane University (2 years)	17,100			
University of Texas (2 years)	27,830			
Texas A. and M. Research Foundation		7,200		
University of Miami				27,400
Total	44,930	7,200		27,400

Bureau of Commercial Fisheries, contracts negotiated with Saltonstall-Kennedy Act funds—Continued

	Fiscal 1955	Fiscal 1956	Fiscal 1957	Fiscal 1958
Biology of oysters:				
Florida State University	$8,600			
Oyster Institute of North America, Annapolis (3 years)	44,200			
Virginia Fisheries Laboratory (3 years)	26,200			
University of North Carolina (3 years)	18,300			
Total	97,300			
Biology of salmon:				
University of Washington, FRI	127,900	$114,800	$131,600	$60,600
Alaska Department of Fish and Game	25,000	4,000		
University of British Columbia	2,750			
University of Buffalo			8,000	
University of Washington				10,300
In process (4 contracts)				50,000
In process (salmon diseases)				7,500
Total	155,650	118,800	139,600	128,400
Biology of sponges: University of Miami	20,000	12,000		
Biology of menhaden:				
Gulf Coast Research Laboratory, Ocean Springs, Miss			100,000	
Tulane University			11,000	
Total			110,000	
Oceanography and meteorology:				
Texas A. and M. Research Foundation	1,500			
Woods Hole Oceanographic Institute (3 years)	200,000			80,000
Scripps Institute of Oceanography		35,000	630,000	
University of Michigan			15,000	
Total	201,500	35,000	645,000	80,000
Biology of blue crabs: Oyster Institute of North America, Annapolis			80,000	
Biology of king crabs:				
University of Southern California			62,448	
Alaska Department of Fish and Game			14,650	
University of Washington				28,070
Total			74,098	28,070
Fish culture: University of Oklahoma	38,200		40,000	
Handbook of fishery data: National Academy of Sciences	15,000			
Educational and training films and other consumer education media:				
Lee Productions, Inc., New York	25,000			
De Luxe Studios, New York	24,000			
Byron Inc., Washington, D. C.	13,000			
Sundial Films, New York			25,000	
Milner Productions, Baltimore			25,000	
Government Printing Office			50,000	
Total	62,000		100,000	
Exploratory fishing and gear research:				
Gulf Marine Ways, Pascagoula, Miss	39,000			
Steam Ways Corp., Tampa, Fla	83,950			
Vessel Charter, Maine			40,000	
Vessel Charter, Florida			29,200	
Vessel Charter, Gulf of Mexico			40,000	
Dwight Simpson Co., Boston			15,000	
Ebasco Services Inc., New York				25,000
Total	122,950		124,200	25,000
Total	1,335,800	540,176	1,637,837	671,195

Bureau of Commercial Fisheries, contracts negotiated with regular funds

Biology of salmon:	*Fiscal year 1958*
University of Washington, FRI	$198,000
Washington State College	6,000
Total	204,000

The CHAIRMEN. I want to join other members of the committee in saying to you how much I have enjoyed your presentation of this subject. I believe that the hearing we have had will be read with interest by those who are interested in commercial fisheries.

I want to personally pay you a high compliment on your knowledge of the entire subject. It startles me.

Is there any further statement?

Mr. MCKERNAN. I appreciate very much the opportunity to be here.

The CHAIRMAN. Tomorrow morning at 10 we will meet and take up the sport fisheries. The committee will stand adjourned until tomorrow morning at 10 o'clock.

(Thereupon, at 12:15 p. m. the committee adjourned to reconvene Tuesday, January 14, 1958, at 10 a. m.)

REVIEW OF FISH AND WILDLIFE SERVICE

TUESDAY, JANUARY 14, 1958

HOUSE OF REPRESENTATIVES,
COMMITTEE ON MERCHANT MARINE AND FISHERIES,
Washington, D. C.

The committee met at 9:30 a. m., pursuant to recess, in room 219, Old House Office Building, Hon. Herbert C. Bonner (chairman) presiding.

The CHAIRMAN. The committee will come to order.

The first witness this morning will be Mr. Janzen, Director of the Bureau of Sport Fisheries and Wildlife, Fish and Wildlife Service.

STATEMENT OF DANIEL H. JANZEN, DIRECTOR, BUREAU OF SPORT FISHERIES AND WILDLIFE, FISH AND WILDLIFE SERVICE, DEPARTMENT OF THE INTERIOR

Mr. JANZEN. Mr. Chairman, my name is D. H. Janzen, Director, Bureau of Sport Fisheries and Wildlife, to which I was appointed 9 months ago. For the previous 10 years I was regional director for the Fish and Wildlife Service in charge of all field operations in the Middle Western 11 States with headquarters at Minneapolis.

I was born in Minnesota, raised on a farm in Montana, and finished my schooling in Oregon, graduating in forestry at Oregon State College. I started with the old Biological Survey in 1929. I worked for about 4 years in land acquisition on the newly initiated national migratory-waterfowl program and was then transferred to the newly formed branch of game management at about the time Ding Darling was appointed director of the survey. That Branch had as its responsibilities enforcement of our waterfowl regulations and predator- and rodent-control operations. I worked under that arrangement for about 7 years, was transferred to Minneapolis as assistant regional director in 1940, and then was made regional director in 1946.

The CHAIRMAN. You may have a seat, Mr. Janzen.

Mr. ALLEN. Mr. Chairman, may I ask at this point what the principal work of the service is in the 11 Middle Western States?

Mr. JANZEN. We have all fields except research. All operations of the Fish and Wildlife Service except commercial fisheries and fish and wildlife research are decentralized.

Mr. ALLEN. Has it become predominantly migratory waterfowl, or large or small animals, or fresh-water fish?

Mr. JANZEN. In the Middle West migratory-waterfowl management was probably the biggest workload. We had quite a number of fish hatcheries. We had some predator- and rodent-control work in the Middle West, but the migratory waterfowl probably was our greatest responsibility and took most of my time.

Mr. ALLEN. Let me interrupt at this point. I regret we can only run the committee meeting until 11 o'clock this morning due to the fact that the Democrats are having a caucus.

Mr. RIVERS. I doubt that Congress will be in session. One of our colleagues died.

The CHAIRMAN. That is right. We will proceed now. I certainly regretted to hear of Mr. Andresen's death.

Mr. JANZEN. Mr. Chairman, in the interest of saving time we have prepared a series of slides which will depict the most important problems facing the Service. I am going to cover principally wetlands preservation. I think your committee has been interested in some legislation along that line plus enforcement problems and our wildlife research.

In addition, after I get through if we have time I have a report on sport fisheries, which will be given by John Gottschalk, Chief of our Fisheries Division, but in view of the Committee's stated interest in these other points I thought I would testify first.

I would like to request, Mr. Chairman, that there be inserted in the record a report we have compiled on the programs, accomplishments, and problems of our various branches since 1955 when you held your last hearing. This is rather detailed information and we will not be able to cover all of it this morning.

The CHAIRMAN. It will be inserted at this point in the record.

(Report submitted by Mr. Janzen follows:)

DEPARTMENT OF THE INTERIOR, FISH AND WILDLIFE SERVICE, BUREAU OF SPORT FISHERIES AND WILDLIFE, STATEMENT OF DANIEL H. JANZEN, DIRECTOR

The last report to this committee about Federal fish and wildlife activities and responsibilities was made by the Fish and Wildlife Service in 1955. Since that time the service has ceased to exist and has been replaced by the United States Fish and Wildlife Service and two subordinate bureaus. As Director of the Bureau of Sport Fisheries and Wildlife, my report deals with its activities. As the technical Federal agency responsible for measures concerned with game birds, mammals, and sport fish, this Bureau has a wide range of research and administrative responsibilities. There follows, under the titles of the operating branches, statements of accomplishments since the last report was made to the Committee on Merchant Marine and Fisheries in 1955, and the problems currently confronting us.

SUMMARY OF ACTIVITIES

BRANCH OF FISH HATCHERIES

The program

Wise utilization of a natural renewal resource is the primary goal of fishery conservation. The directed, constructive application of techniques of manipulating fish populations, their habitats, and their exploitation, so as to channel the productive capacity of the resource into the desired harvest pattern, is fishery management. A major contribution of the Federal Government to the management of the Nation's fishery resources, has been through the maintenance of the Federal fish-hatchery system.

Branch activities are based on a policy of maximum cooperation and assistance to the States to maintain game-fish populations in inland waters. The major activity and primary objective of the program is to propagate and distribute game fish to waters in accordance with recognized needs. The improvement of hatchery operations aimed at the economical propagation and distribution of fish of the species, size, number, and quality that best meet the need is a part of the program.

Administration of the program is decentralized to five regional offices covering the United States. A small Washington office staff is responsible for determination of major objectives, fields of activity, general policies, broad coordina-

tion of regional programs, and liaison with cooperating agencies on the national level. Regional levels are responsible for planning and assigning work programs, scheduling of operations, and coordination with States and other local cooperating interests.

The Fish and Wildlife Service has 98 fish-cultural stations producing trout, salmon and pondfish such as bass, bluegills, catfish and other species. These fish are distributed primarily to Federal waters and to other waters open to public fishing. The production and distribution of these fish is the major activity of the Branch of Fish Hatcheries. Included in the program, the rehabilitation of Atlantic salmon populations, the Columbia River fisheries program, which is a cooperative effort with the States to preserve and develop valuable salmon populations threatened by the construction of Federal and other dams, and the rehabilitation of once-important lake trout populations in the Great Lakes, which have become depleted by an infestation of sea lampreys.

Accomplishments

A generally improved efficiency of hatchery operation is indicated by (1) total fish output increased from 1,399,000 pounds in 1954 to 1,852,000 pounds in 1956, (2) conversion of fish food to trout and salmon was reduced from 3.9 in 1954 to 3.3 in 1956, and (3) the number of warm-water fish produced increased from 47,734,000 in 1954 to 81,555,000 in 1956. At the same time, the employment of permanent personnel has been held to approximately the same level, 360 in 1954 to 378 in 1956. These important accomplishments can be attributed largely to improved disease control methods, a better understanding of fish nutritional requirements, improved fish hatchery management techniques, and increased appropriations for the improvement of facilities, purchase of fish food, and the construction of modern hatcheries in needed areas.

The training of key personnel has been continued at the Cortland, N. Y., fish-cultural station (trout nutrition), Marion, Ala., fish-cultural station (warm-water fish culture), and recently, fish disease laboratories at Leetown, W. Va., and Seattle, Wash., have been made available for the training of a limited number of employees in the treatment of fish diseases. The personnel training program has been effected by obtaining civil service approval of a professional development agreement, for the purpose of professionally developing fish hatchery managers and fishery biologists. Also, the Civil Service has revised the classification standards for fish culturists, bringing them up to a status with workers in comparable fields. This will add greatly to employee incentive and to easing the recruitment problem.

As maintenance funds were increased between the fiscal years 1955 and 1957, urgent repairs were accomplished at many hatcheries. Major improvement projects were accomplished at 14 hatcheries from funds provided specifically by Congress in 1956 and 1957. The construction of new fish hatcheries was initiated at Miles City, Mont., Cedar Bluff, Kans., Jackson, Wyo., Gavins Point, S. D., Norfork, Ark., Pisgah Forest, N. C., Paint Bank, Va., and Bowden Springs, W. Va. during the period.

A long-range program for Federal fish hatcheries was presented to the Bureau of the Budget on October 23, 1957, which included schedules for the development of existing hatcheries and the establishment of new hatcheries, projected over a 10-year period. The long-range program was developed from studies of an increasing and shifting fishing pressure on inland waters, scheduled river basin projects, and estimates of fish stocking requirement over a 10-year period to maintain game-fish populations.

Problems

Fishing licenses issued in the United States have increased from 11 million to about 19 million in the past 10 years. As the population of the Nation continues to mount, and as recreational fishing is increasingly popular, there is every reason to believe that game fish populations will be subjected to greatly increased fishing pressures in future years. At this time, many trout waters are fished so heavily that trout populations can only be maintained by stocking legal sized fish to insure a fair return to the fishermen's creel.

Over 2 million farm ponds exist in the Nation today and over 100,000 are being added to this total annually. Great dams on most of the major river systems are changing fish habitat through the creation of large reservoirs, impassable barriers to fish migration, and changing water temperatures and flow patterns. Many of the States are embarking on programs to eradicate undesirable fish species from reservoirs and even entire river systems. This all adds to the

problem of producing fish of the species and size required for restocking purposes and for the management of inland waters. States and Federal efforts must be fully correlated to meet this problem.

The construction of great dams on streams tributary to the Pacific Ocean has seriously endangered important salmon runs. The States and Federal Government are making a cooperative effort to solve this serious problem. An invasion of sea lamprey has practically eliminated the once great lake-trout fishery on the Great Lakes. The restocking of the lakes, when eradication of the lampreys is accomplished, will require that additional trout rearing facilities be established to assist existing State and Federal hatcheries to meet production quotas.

Research is an important tool in the management of the sports fishery resource. The objectives of research on fishery biology are (1) to describe and measure the nature and extent of the natural populations comprising the fishery resources of the Nation; (2) to discover the natural laws controlling the varying sizes of these populations and the factors which influence their reproduction, growth, migration, and death rates; (3) to develop systems of their rational exploitation in accordance with the principles of conservation; and (4) to perfect means of cultivation and management of the supplies to permit safe maximum utilization. Research on fish nutrition and pathology is undertaken to improve hatchery practices, and the stocking of streams and lakes. Although a certain amount of research has, and is being done on the sport fish resource, this research is lagging far behind the current need. As recreational fishing is increasing greatly each year, and as the States and the Federal Government are charged with the responsibility to maintain the sport fishery, fishery research should be expanded to an adequate program. Basic research, fishery management and fish propagation are interdependent in the program to maintain and improve the inland fishery.

The recruiting, training, and retention of qualified personnel has always been a problem in the field of fish culture. Recruitment of individuals, with an adequate background in the biological sciences, has been difficult as similar fields of endeavor offered greater compensation. Also, as fish culture is a highly technical occupation, considerable experience and training is necessary to qualify an employee for a responsible position. The number of fisheries students graduating from colleges has been inadequate to meet the needs of the States and the Federal Government, and this problem has become acute in recent years. The recent modification of fish cultural classification standards will be of material benefit toward meeting the problem in the Federal service, and within service training recently initiated by agreement with the Civil Service Commission will also help. However, there is a serious need for a large number of qualified people in the fisheries field, and every effort should be made to promote the education and training of prospective employees.

Many Federal hatcheries include a water supply and available land to permit expansion of rearing facilities. Others have additional rearing space that could be utilized for expanding the production if additional funds and manpower become available. It is apparent that every facility and every trained worker available will be needed in the effort to maintain the inland sport fishery in future years.

SPORT FISHERY RESEARCH

Accomplishments

Fishery research is the systematic attempt to solve important problems of resource conservation. One big problem in fishery conservation and management is represented by the question: How may the results of research be more quickly applied to situations where they are needed? There will always be some lag between research findings and their applications to hatchery production, to regulatory measures, and to the technology of field management. The more quickly such findings may be applied the more rapidly our conservation aims can be achieved and better sport fishing along with the removal of unnecessary restrictions insured. Notable progress along this line has been made since the 1955 hearing before this committee.

By agreement with the Civil Service Commission there are now three in-service training courses for fish culturists. The courses are both intensive and extensive and cover all fields of fish husbandry, with particular emphasis on nutrition and disease recognition and control. The college level courses are 1 year in duration and are given at Cortland, N. Y., Seattle, Wash., and Leetown, W. Va. At the end of the courses the fish culturists resume active management of a hatchery. Experience with such training already proves that it results in greater economy and efficiency in practical operations.

In the field of hatchery fish disease research, there has been some good progress for trout and salmon; no work has been possible yet for the warm water species like bass and sunfish which are widely used for stocking farm ponds.

New and troublesome diseases keep showing up in fish just as in humans. Viruses and rickettsias, not known a few years ago, are suspected now of playing an important role in limiting production at some times in some hatcheries. There is no satisfactory treatment for virus diseases but preventive measures have been developed to reduce incidence.

Feeding practices have been improved for prevention of disease transmission as the result of research findings. It is now known that some foodstuffs must be specially treated before use because they are carriers of disease. The polio-like outbreak among salmon which was described to the committee at the 1955 hearing is under control now by this method.

For other infections, especially those of bacterial origin, successful diagnostic and treatment methods have been found and are being applied. The sulfa compounds and the antibiotics are being used with generally good results. In some cases, drug resistance has developed and new drugs have been found to combat the particular disease. Chemicals have been found which successfully treat fungus infections of fish.

The researchers on disease, alert for possible ways to minimize hatchery losses, have tested strains of trout which seem to be resistant to certain disease organisms; this calls attention to the possibility of using such fish or hatchery brood stock and of selectively breeding for disease-resistant offspring. It is probable that these or other desired characteristics can be as successfully selected for fish as for farm animals and plants. Such a program would be long-term and expensive, but promises success and profit eventually.

Recently a comprehensive library of normal fish tissues and of tissues showing pathological conditions has been accumulated for comparative and diagnostic purposes. The materials in this collection are available for reference to all interested persons. Additionally, more than 100 reference or test cultures of bacteria isolated from fish with various pathological conditions are maintained at one of the laboratories; the sensitivity of all of these cultures to many of the antibiotics and sulfonamides has been determined. The collection of cultures provides a useful tool for rapid typing of bacteria which may cause either low-grade infections in hatchery fish or, at times, explosive mortalities which would otherwise remain unexplained.

Disease research findings are being published regularly in nontechnical language for fish culturists so that prompt application is possible in practical situations.

For the past 2 years a technician especially trained for the job has been visiting eastern Federal hatcheries routinely and on emergency call to make diagnoses and recommendations for treatment. He also is accumulating data on the distribution of kidney disease of trout to learn what particular conditions favor outbreaks of this disease. This innovation is developing close liaison between the laboratory and the hatchery, thus improving both the application and applicability of research to production practice.

Recent research has established that trout require 10 of the B-complex vitamins: Biotin, niacin, riboflavin, choline, thiamin, folic acid, pantothenic acid, inositol, B_{12}, and pyridoxine. Over a 34-week experiment it was shown that there is no need for five other members of the vitamin-B complex.

The use of radioactive tracer techniques in the laboratory has made it possible to demonstrate that trout take up calcium directly from the water, both in the egg stage and as feeding hatchery fish. Similarly, it has been found that fertilizing the water with phosphate benefits trout directly and not solely through the food chain as previously supposed.

Fish hatchery feeding has been changing as nutrition research has progressed. At the Cortland, N. Y., fish nutrition laboratory, a pelleted diet has been developed which has maintained trout with good growth and conversion and low mortality for the past 18 months. During this period no meat has been fed. The fish so fed do not respond as well to handling as the meat-fed fish, but progress so far suggests that a complete pellet, cheaper, easier to store, handle and feed, may soon be available.

Some of the salmon must be held in ponds for months to reach spawning condition. Traditionally they have been trapped, then transported to the holding ponds where injury and disease during the ripening period has caused heavy losses and consequent reduced egg production. One of the laboratories has

developed and tested a practical electrical diversion weir to divert migrating adult salmon directly into the ponds, thus eliminating trapping, handling, transporting, and escape and also eliminating expensive installation and maintenance of physical barriers at the pond outlets. Complete specifications for construction and for electrical requirements have been outlined. Available line power is used in the installation at small operating cost. Tests have been run on the effects of electricity on the fish from the standpoint of their egg production and quality and condition of the resulting hatched fry and have shown that there is no adverse effect.

A rectangular, recirculating rearing pond for salmon hatcheries has been developed and tested and has proved somewhat superior in carrying capacity, disease inhibition, food distribution and in self-cleaning properties to any of several types of ponds now in use. Use of this facility in the construction of new hatcheries or expansion of old ones should make for cheaper and more efficient operation.

Cleaning of hatchery ponds and raceways to control algal growth has been a time-consuming job and is expensive in terms of labor requirements. Although tests of potentially effective algicides for use at hatcheries are continuing, a reasonably satisfactory one for controlling green algae in rearing ponds has been found; this has been shown to be effective when used at 1 part in 1 million parts of water for a weekly 1-hour exposure.

A vertical, high-humidity incubator for fish eggs and fry which is extremely economical in the use of space and water has been designed, thoroughly tested for practicality, and recommended for regular hatchery use. It offers a possibility of economical control of the rate of embryonic development through manipulation of the temperature of the water.

Research to improve fishery-management practices is becoming more and more important as fishing pressure on public waters increases. Limiting pilot studies are designed to develop new techniques of broad application for assessing productivity of lakes and streams, to evaluate practices of stocking hatchery-reared, catchable-size trout in streams, to assess the physical vitality of hatchery fish, and to determine the effects of various conditions, natural and imposed, on the fish and their environments. The information derived from these studies will be helpful in formulating improved management and conservation practices to develop the productive capacities of specific waters for maximum sustained use.

Fishing possibilities have improved steadily over the past 2 years in waters of Shenandoah and Great Smoky Mountains National Parks as the result of experimental management studies and the application of management measures based upon them to different stream situations in the two parks. One experimental measure in the Great Smokies which is working excellently toward improved fishing opportunity is the opening of 4 streams, 2 with and 2 without seasonal closure, to fishing for fun only; that is, the fish caught are returned to the water. This rather radical plan has had exceptionally good public response from the outset. Of course it is no panacea but it may prove a useful technique in many special areas.

Massive spraying of insecticides to control forest pests, an alarming trend, has been followed in one large area in the Rocky Mountain region by Bureau biologists to assess damage to stream fish and their food supply. It has been possible to influence treatment methods and doses and thus minimize damage to the fish. An unexpected, but important finding from this work has been that, even when the fish are not killed, there is a remarkably high accumulation of DDT in the fish tissues. This is at least potentially dangerous to the fish and perhaps to the fisherman who catches and consumes them.

Several years of careful work on the waters of Yellowstone Lake, Yellowstone National Park, have demonstrated that natural spawning year after year can sustain trout production and trout fishing in the lake without supplement from artificial propagation. As a result of this finding, eggs are no longer being taken from the trout there for hatching, rearing, and stocking. Continuing account of spawning success and fishermen catches will follow the course of this important fishery, enjoyed by over 225,000 anglers during the past year.

There has always been a tendency to deprecate the quality and survival ability of hatchery fish as compared with wild fish. Over a considerable period it has been found that hatchery fish produced under good conditions of nutrition and disease control, and properly handled and planted, are at least the equal of wild fish. This result points up the possibilities for continued improvements in all aspects of fish husbandry for ultimate resultant economy, efficiency, and of course, better returns to the fishermen.

Problems

Problems in fishery conservation which have not been solved through research but which are susceptible of solution and which are important to the full development of a rational conservation program for our national fishery resources may best be stated as questions for which answers are not yet available. A few of these questions are listed below under two headings—problems of hatchery management and problems of field management of fishery resources:

Fish culture.—What are the genetic characteristics of different species and different races of the species and how may these be used for selection of most desirable qualities of growth, disease resistance, and fertility?

Can salmon, by some simple treatment, be introduced successfully directly into salt water as fingerlings? Can salmon be reared in salt or brackish water for better growth and survival?

Can drugs or other chemicals be used effectively, without harm to fish, to improve transportation and distribution, decrease mortality, and increase carrying capacity of equipment?

What are the causes of fluctuations in warm-water fish production in hatchery ponds and how may they be controlled—diseases, food supply, predation, water quality?

What chemicals may be used safely for selective control of plants, predators, and unwanted species of fish?

How can spawning of warm-water fish be controlled—to induce or inhibit spawning for special purposes of fish husbandry?

What are the nutritional requirements of desirable warm-water species and how may they be met by fish culturists?

Fishery management research.—What are the ecological requirements for marine and anadromous sport fishes and how may these be reconciled with inshore development projects?

What are the life histories and population characteristics of important marine game species—marlin, sailfish, etc?

How can these facts be used to improve fishing opportunities?

What is the relative value to sportsmen and commercial fishermen of catches of the same species? To what degree are these two forms of exploitation compatible?

What effects do evaporation inhibitors have on fish and fish food organisms?

What are the safe levels of use of various pesticides?

How may water levels and streamflows be manipulated for the benefit of fish production?

How may streams and lakes be treated effectively to enhance fish production if they are low producers because of pollution or other water quality?

How can the management of large reservoirs be improved for enduring productivity of desirable species?

How may the Alaskan game fishes be maintained on a basis of maximum sustainable productivity?

Can selective chemicals be found and used for population manipulation and changes in species composition in fresh waters?

FISHERY MANAGEMENT SERVICES

Accomplishments

Federal efforts in the field of fishery management have always recognized the primary responsibility of the States for the management of nonmigratory species of fish and game. The States have made rapid progress in their fisheries programs in the past few decades, but a number of important needs have remained unfilled. By their nature, these aids in the development and conservation of our recreational fishing can only be satisfactorily met by activity at the Federal level. The national policy in these matters was set in the Fish and Wildlife Act of 1956, which authorized the Secretary of the Interior to "* * * take such steps as may be required for the development, advancement, management, conservation, and production of the fishery resources * * *." Fishery management was thus recognized as an important function of the Bureau, and the skeleton of an organization to carry on essential management work in the field has been completed. Key personnel from the Branch of Fish Hatcheries, trained and experienced, form the nucleus for the Bureau's fishery management organization.

For several years, technicians attached to the fish hatcheries operation have assisted in the preparation of fishery-management programs for military establishments, Indian reservations, wildlife refuges, and other Federal areas. This

assistance insures maximum recreational benefit through fishing not only for the residents in these areas, but also for many thousands of citizens who are permitted fishing privileges. Of particular interest is the use made of expanded fishing facilities available at veterans' hospitals, where fishing is frequently an important part of the recreational program. The military services generally have cooperated enthusiastically in this management work, both because of the good effect on morale and because of the favorable reactions among neighboring communities.

Based on a cooperative agreement approved December 17, 1956, the Fish and Wildlife Service provides technical personnel to survey waters on Air Force bases, make recommendations for management and development of the aquatic resources and assists in carrying them out. This joint program is working well. Many additional man-days of recreation have been provided young men serving on these military areas. The military areas have encouraged the organization of rod and gun clubs among their own personnel. These clubs are composed of people informed on the subject of sport fishing. They provide a means of maintaining interest in and continuity for the fish and game programs on the individual bases.

In 1956, fishery-management personnel visited 116 Federal installations to conduct biological reconnaissance studies, develop management plans, or inspect work previously completed. The evaluation of stocking programs and the improvement to angling achieved by stocking hatchery fish is a major responsibility of the Bureau. A start has been made in this activity, but much remains to be done before it will be possible to assure that hatchery fish are always used most advantageously. Other accomplishments include development of close cooperation with other land-management agencies, such as the Soil Conservation Service and the Agricultural Extension Service, in demonstrating good farm pond management methods, including stocking procedures. Although only a limited number of public demonstrations have been possible, these have been well received in the communities where presented.

The Bureau has made a worthwhile contribution to the preservation of sport-fishery resources through several special management activities. For example the cooperative upper Mississippi fisheries program involves the interests of the five States bordering the upper river and the Fish and Wildlife Service. The Bureau provides a coordinator for this program of fishery research and management. In 1955, a group was organized under the name of Steering Committee for Roanoke River Studies to plan and conduct a comprehensive research and management program on the lower Roanoke River in North Carolina, and thereby to assure the protection and survival of the striped bass in the face of power dams, pollution, and many other uses of Roanoke River water. The Bureau, as a member of this group, provides the chairman and also contributes funds and manpower to some phases of the 12-agency cooperative project. During the past year, management biologists have actively served on other managing and coordinating committees, such as the fish and wildlife committee for Clark Hill and Hartwell projects, Georgia and South Carolina; and the committee for study of the effects of strip mining operations, Cumberland National Forest, Ky.

Problems

One of the Bureau's most important fishery-management problems is concerned with the best possible use of the fish produced at the Federal fish hatcheries. Although a small beginning has been made in evaluating the results of stocking hatchery fish, much greater attention must be given this problem in view of its magnitude and cost to the public. The 1956 output from our Federal hatcheries reached 180,178,095 eggs, fry, fingerlings, and adult fish, weighing 1,851,734 pounds. The cost of producing and distributing these fish was more than $4 million. Field studies have shown repeatedly that undirected planting programs result in severe mortality of stocked fish. Some plantings of trout show no recovery by the angler, many are in the 20- to 40-percent range, and only where healthy fish are planted in carefully chosen suitable locations does the return to the angler exceed 4 out of 5 fish stocked. Thus the cost of fish planted—and actually caught—may be much greater than it appears. Our activities must be marked by greater efficiency and economy—not only in the hatchery where notable progress has been achieved—but in subsequent stages of the operation as well. The importance of carrying out a continual evaluation on the final success of stocking fish is readily apparent.

All applications for fish containing questionable or incomplete information, or which indicate a biological problem, should be carefully examined before fish

are allotted. Likewise, applications for larger bodies of water which involve considerable numbers of fish should also be reviewed prior to approval and the allotment of fish. Biologists can determine that species of the right size and age are stocked in the most favorable waters. They can also assure that management programs are prepared sufficiently in advance that hatchery production can be properly planned and distribution schedules made in the most economical fashion.

There is a dirth of printed literature on sport-fisheries management available to interested persons. An enlarged program to provide information in the form of leaflets and bulletins on various phases of fishery management is badly needed. Printed materials relieve the necessity for personal visits to problem waters and permit much wider coverage than is otherwise possible.

There has been no opportunity to develop and maintain an inventory of sport-fishery resources for the entire country. Facts are essential on the status of present resources, to what extent they are being used, to what degree they can and must be developed for the future. Such knowledge would include both fresh-water resources and those of the coastal areas where marine species are involved. Technical information on fish populations, the rate of growth and life histories of the more important species, the rate at which they enter the sport fishery, and the economic value of the resource, must all be known and correlated before a proper picture can be developed and suitable plans laid for future action.

One of the problems besetting State conservation departments and the Federal agencies today is the lack of trained workers in the fisheries field. It is estimated that our present-day needs call for about 250 new fishery management biologists each year for the next 10 years. Less than this number are being graduated from our colleges and universities and many of those who are trained are finding employment in other fields. Sometimes this is due to more favorable salaries and apparently greater opportunities for personal advancement elsewhere. In other instances, the students return to school for additional work or are taken by the military services. There is a most pressing need for assistance in the training of fishery management biologists for service with the Federal Government, with the States, and to a limited degree in private employment. Since the Federal Government is one of the primary employers of graduates in this field, it must accept its share of the responsibility for the training of potential employees. Some of the fishery training units might be located in connection with the present cooperative wildlife research units. In other cases, the work can be done entirely by the college or university with financial assistance to provide fellowships and funds for employing students on special projects, obtain equipment, etc. Training, however, should not end with graduation, and there is a great need for providing refresher courses and short-term courses for people already employed in fisheries work.

There is an unlimited field involving other special needs which so far have not been met. Many of these needs are recurrent, while others arise when new discoveries in other fields of science are placed in use and have a direct effect upon fisheries resources. As examples of the latter, it is imperative that new chemicals used in controlling weeds, insects, and other forms of life considered undesirable, be tested on a pilot scale to learn their effect on fish and aquatic organisms. There is ample information already at hand to show the catastrophic results which can quickly occur from wide-scale use of untried chemicals in control operations. Such substances should first be tested by a research laboratory, then pilot tested in the field by the Bureau's fishery management staff.

The development of water resources leads to many problems involving recreational fisheries. Many of the watershed programs now being activated are supported by Federal funds and have direct effects on sport fishing. To achieve the fullest recreational potential which exists following development, it is necessary to know much more than whether a river below a dam will support trout. There are many examples of failure to fully utilize an available aquatic resource through the lack of applying progressive fishery management practices.

Although the field of sport fishery management is a relatively new and broad one, its objective is clear—the enlargement of recreational opportunities through the creation and maintenance of good fishing.

FEDERAL AID

Accomplishments

Federal aid in fish and wildlife restoration appropriations during the past 2 years have totaled $44,705,303.99, of which $34,838,166.39 was for wildlife and

$9,867,137.63 was for fish. As outlined in the following work categories, these funds have financed a wide range of measures beneficial to fish and wildlife.

During the past 2 fiscal years 45 States submitted 610 projects to obligate $6,898,528.40 for the acquisition of 309,232.15 acres of land on the two programs.

Under the Pittman-Robertson Wildlife Restoration Act the States obligated $5,622,549.52 to purchase 277,348.91 acres on wildlife areas and 22,546.08 acres on joint fish and wildlife areas. Dingell-Johnson fish resoration funds were obligated in the amount of $1,275,978.88 for the purchase of 9,377.16 acres to benefit the fishery program and its share of the 22,546.08 acres purchased on joint fish and wildlife projects. Lands are purchased for waterfowl areas, big-game ranges, fishermen and hunter access, fishing lakes and lake sites. One of the largest transactions was Colorado's purchase of 15,264 acres for $445,000 on the Piceance Creek Big Game Range. Over the 2-year period the States purchased 128,156 acres of land for waterfowl.

All the States, Alaska, Hawaii, and Puerto Rico obligated Federal aid funds to carry on fish and game development activities. Forty-seven percent of the funds obligated during fiscal years 1956 and 1957 were to implement the various types of development. These included $13,950,090.43 of Pittman-Robertson funds and $3,981,493.62 of Dingell-Johnson funds.

The activities are many and varied. Wildlife habitat improvement and development was by far the largest single activity with all States participating in some phase of the work for one or more species. Among these is the program of cooperation with private landowners in the establishment and preservation of suitable wildlife food and cover to create better living conditions for farm-game species. Waterfowl benefit from construction of water impoundment structures to create marshes. All 48 States have participated to some extent in development, operation, and maintenance of waterfowl areas, utilizing over $5 million of Federal aid funds during the last 2 years for that purpose. Big-game winter ranges are improved by fencing to exclude livestock and cover manipulation to provide more food. An important byproduct of these activities is the making available of land on which the sportsmen can hunt. The States are also emphasizing, through working agreements, wildlife habitat improvement work on other State and Federal lands.

The Dingell-Johnson development program has been highlighted by three major activities: the construction of 56 new lakes having over 5,000 surface acres; the rehabilitation of 157 established bodies of water with 25,000 surface acres by poisoning the unwanted fish populations and restocking with desirable species; and the construction of fisherman access facilities such as roads, parking areas, and boat launching facilities. Large dividends to the fishermen, in the form of increased fishing opportunity, have resulted from these activities.

Fishery investigational activities carried out with the aid of Dingell-Johnson funds concern a large variety of game fish and are being conducted in ponds, lakes, impoundments and streams, as well as in coastal areas. During the past 2 years the States submitted 309 projects which obligated $5,053,534 of Federal aid funds.

Accomplishments of these investigations are many and varied. The selective control of gizzard shad by chemical treatment of the water was developed by Texas as part of a fishery investigational project. This technique permits the destruction of undesirable populations of shad without harming game fish, thereby establishing excellent fishing in waters which formerly offered practically nothing in the way of sport fishing. The recent use of this technique at the 34,000-acre Lake Apopka in Florida is the largest operation of this kind ever undertaken. The lake was completely treated and observers estimate that 75 million undesirable shad were killed. Fishing has since improved tremendously.

An understanding of fishing success is of paramount importance in evaluation of management programs; consequently creel censuses are carried on in many States. For example, the creel census at Wononscopomuc Lake in Connecticut revealed that 2-year-old brown trout stocked prior to the fishing season and during the early part of it furnished the greatest return of stocked fish, amounting to 57 percent. A statewide census in Missouri showed that 70 percent of the fishing occurred on streams, 13 percent on large reservoirs, and 17 percent on ponds.

Studies to improve fish culture operations were carried on by several States. Montana completed a Trout Hatchery Manual containing information on nutrition as well as treatment and diagnosis of diseases. Approximately 300 subjects are included with over 2,000 references. Through experimental work, New York

developed a device which uses pulsating compressed air to scatter food over hatchery ponds, thereby enabling greater use by the fish with a reduction in hatchery labor costs.

The use of rotenone for sampling fish populations is one of the most widely used techniques. However, it remains toxic longer than is necessary and has limited value in sampling stream fish populations because of the stream current. Through investigation New Hampshire developed a method for detoxification of rotenone-treated water by the addition of certain chemicals. This discovery opens the way to broader and more efficient fish population sampling, a basic achievement in fishery management. Also concerned with fish population sampling but dealings with king salmon and steelhead trout, California evaluated the use of large cylindrical traps 10 feet in diameter and 20 feet long in the Sacramento River. The development and successful use of these traps provides a new means for sampling in large streams.

Numerous studies are in progress which have much management and restoration potential. These include experimental use of electricity and poisonous baits to selectively control undesirable fish; the use of underwater diving equipment to gather information on fish abundance, distribution and behavior; the use of high-frequency sound to direct fish movement; stocking marine fish in inland saline waters; and the application of statistical methods of biological problems.

In the Pittman-Robertson program about 24 percent of the apportionments are expended on research or investigational activities. This represented an obligation of $6,785,746.41 of Federal aid money on 400 projects for the past 2 years.

These research endeavors have involved all types of life history and management problems on more than 75 species of game birds and mammals. The collecting of inventory and harvest data was a prominent activity, as it is upon this information that proper hunting seasons and bag limits can be set so as to keep the game populations on a stabilized basis without damaging their habitat or man's crops. Based on information gathered by Federal aid biologists in New Mexico, that State has had two hunting seasons on the Barbary sheep—the first hunting of this species on the North American Continent.

The value of coordinated effort in attacking common problems is becoming more fully appreciated each year. Utilizing Pittman-Robertson project personnel, practically all of the States are cooperating with the four flyway councils and working closely with each other and the Bureau of Sport Fisheries and Wildlife in waterfowl investigations and the development of flyway management plans. Many of the States are banding mourning doves so as to obtain a continentwide picture of their movements. Ten Southern States have pooled their resources into one big project for attacking a deer-disease problem which occurs over the entire area. A new exotic game bird, the Coturnix quail, is being liberated and studied with Federal-aid funds in 10 States and in almost every type of habitat. The introduction of game birds from Spain and Pakistan continued with the delivery of 1,297 birds to five States during the past two years.

California and Florida demonstrated a new technique for transplanting game birds into new and inaccessible areas by utilizing a low-flying airplane to drop chukar partridges in the former State and wild turkeys in the latter.

New Mexico found that beaver can be beneficial to trout under certain circumstances. Sections of streams (at an altitude of about 9,500 feet) containing occupied beaver dams and sections without such dams were electrically shocked to remove the fish. The results showed that the beaver-dam sections with higher water temperatures and several times as much trout food, produced more and larger fish than the other sections.

The dissemination of information on project findings is one of the important yardsticks of research accomplishment. During the past 2 fiscal years, 685 publications, consisting of magazine and journal articles, bulletins, and books were published, based on program findings.

A major legislative accomplishment occurred with approval of the amendment of August 12, 1955 (69 Stat. 698) to the Wildlife Restoration Act. This authorized the appropriation of $13,467,468.61, representing receipts that accumulated during the years when annual appropriations underran income. The amendment provided for the appropriation of those accumulated receipts in five equal annual installments beginning with fiscal year 1956.

The amendment of July 2, 1956 (70 Stat. 473) provided for treatment of the Territory of Hawaii as a State for the purposes of apportionment of Federal-aid funds. The first such apportionment was made for fiscal year 1958.

The island of Guam became eligible for participation in both Federal-Aid Acts under the amendment of August 1, 1956, and received its first $22,000 apportionment in fiscal year 1958.

MANAGEMENT AND ENFORCEMENT

Accomplishments

To carry out its responsibilities in respect to the enforcement of 12 Federal conservation laws including regulations enacted pursuant to the Migratory Bird Treaty Act, the Bureau employs 128 United States game management agents for assignment to the United States and 24 such agents in the Territory of Alaska. Since 1955 the stateside force has been increased by 9 agents, most of whom have been assigned to those States which heretofore did not have the full-time services of an agent.

Each year for the past 3 years, United States game management agents have reported the apprehension of approximately 6,000 game-law violators. Subsequent prosecution has resulted in conviction in 98.2 percent of the cases. Throughout the year game management agents continue to assist law enforcement offices of other Federal agencies and State agencies responsible for fish and game conservation.

In those States in which Bureau employees can be commissioned as deputy State game wardens, game management agents assist in the apprehension and conviction in State courts of persons charged with violations of State game and fish laws and in many instances during the course of a year apprehend more people for violations of the State game code than they do for violations of the Federal conservation regulations.

In combating the illegal activities of well-organized and closely knit gangs engaged in the killing of game for the market, conventional enforcement activities are almost always ineffective. For this reason, in addition to game management agents, the Bureau employs highly trained criminal investigators who specialize in undercover work.

In 1954 the Bureau instituted two separate undercover programs, one in Texas, the other in Maryland. A third program manned and financed jointly by the Federal Government and the State of Tennessee was instituted in 1955. All three were brought to a successful conclusion in 1956.

The Tennessee operation resulted in the apprehension of 28 market hunters, who had been commercializing in waterfowl and resident game in the vicinity of Reelfoot Lake. The Texas program culminated in the greatest roundup of market hunters in the history of game-law enforcement in this country, when United States game management agents assisted by United States marshals and State wardens arrested 44 market hunters, 40 of whom were later tried and convicted. Shortly after the Texas roundup, 6 Maryland residents were charged with market hunting as the result of evidence obtained by a Service undercover operator.

The gathering of data concerning the status of migratory birds is one of the most important Bureau functions. During the past 3 years survey methods have improved and there has been better coordination with the several agencies and organizations which cooperate in obtaining the necessary information. Cooperators in the extensive waterfowl breeding ground surveys and banding program conducted by the Bureau in the United States, Canada, and Alaska in 1957, included representatives of 14 State game departments, 5 Canadian provincial game departments, Ducks Unlimited, the Wildlife Management Institute, and the Canadian Wildlife Service. All 48 States aided in the midwinter waterfowl population survey, and the post office hunter kill survey.

During the past 3 years special efforts have been made to improve the procedures that must be followed in the development of the Federal migratory game bird regulations and the regulatory announcement itself. Numerous changes have been made in the announcement in respect to the language used, the appearance, and the arrangement. This past year cartoons were employed to illustrate both the legal means by which birds could be taken and hunting methods which were unlawful. The improved regulatory announcement evoked enthusiastic acceptance from sportsmen everywhere.

Problems

At the time the Migratory Bird Treaty Act was passed by Congress in 1918 vesting in the Federal Government supervisory jurisdiction over the management and preservation of migratory birds, Congress realized that the Federal Government would never be a satisfactory substitute for local self-government in the field of game-law enforcement and for that reason expected and intended

that the separate States would share responsibility for assuring that adequate and reasonable protection was provided such birds.

By reason of the foregoing the Bureau has never considered the establishment of a law-enforcement force sufficient in number to assume full responsibility for providing protection to migratory birds throughout the United States.

Although the Bureau receives excellent cooperation from most States in many phases of its program, the overall situation in respect to the protection of migratory-game birds could be greatly improved if there was greater uniformity in the protection provided by the several States. Unfortunately the degree of cooperation received by the Bureau from the States varies markedly. The reasons for this are as varied as is the protection provided. A goodly percentage of the States do not differentiate between resident and migratory species of wildlife and make a concerted effort to provide reasonable protection to both. Others at times consider all migratory birds as being purely a Federal responsibility. In such instances, as well as those wherein the State has enacted hunting regulations in direct conflict with Federal law, the Bureau's small force of agents are sorely tried in their efforts to protect the public's interest in a wildlife resource. In recent years there has been a marked improvement in the matter of mutual cooperation between the Bureau and the States but there is still considerable room for improvement, especially in respect to enforcement.

Today, more than 14 million hunting licenses are bought by Americans who depend upon wildlife as their principal source of recreation. The result is that greater hunting pressure is being exerted on the Nation's wildlife resources than ever before in history. Unfortunately, in spite of the advances in conservation education and a growing public awareness of the need for additional wildlife protection, unnecessary losses in game due to illegal take have increased as hunting pressure has increased. In this regard it is the considered opinion of most game administrators that a marked reduction in violations, brought about by greater emphasis on law enforcement will increase the available supply of game within a comparatively short period of time. The foregoing is especially true in respect to water-fowl populations. Basically waterfowl populations are dependent upon the number of mated birds which return to the nesting grounds each spring. The abolition of market hunting, duck trapping, and baiting together with a further reduction of less important violations through more effective enforcement will be reflected in increased numbers of breeding pairs of both ducks and geese returning to the nesting grounds. Increased waterfowl populations result in greater liberalization as to seasons and bag limits and in turn greater hunting opportunity for the American public.

In recent years considerable attention has been focused on damage caused by migratory birds. The damage reported runs the gamut from sea scoter predations on scallop beds to woodpecker damage to powerline poles. However, of major concern to the American farmer are crop losses caused by ducks, geese, coots, and blackbirds. Bird depredations occur annually in at least 20 of the 48 States. The amount of damage varies considerably from year to year reaching serious proportions about 3 years of 10. Thus far most of the serious crop losses have been reported from North and South Dakota, California, and to a lesser degree from eastern North Carolina. In the first two States the problem primarily concerns fall populations of migratory ducks, while in California and North Carolina, the losses are caused by wintering populations of birds. In many instances the situation is somewhat aggravated by reason of the fact that farming practices employed lend themselves to depredations. This is especially true in the Dakotas where much of the grain is swathed before it is combined.

In carrying out its crop damage control activities the Bureau procures and distributes grain obtained pursuant to Public Law 654, pyrotechnics, and other scaring devices. Thus far the cost to the Bureau for firearms and pyrotechnics has been relatively low inasmuch as surplus military weapons, search lights, flares, and simulated grenades have been made available for our use by the Department of Defense.

For the past several years most States have escaped serious crop damage caused by waterfowl. However, a vexing and continuing crop depredation problem exists in New Jersey where blackbirds have caused considerable damage to sweet corn. Research specialists of the Bureau in cooperation with State authorities are bending every effort to find a solution to the blackbird problem in New Jersey and elsewhere.

PREDATOR AND RODENT CONTROL

Accomplishments

The Bureau is charged with aiding and conducting predator- and rodent-control programs on the public domain and on State, Territorial, and private lands. It also has the responsibility of developing effective control techniques and providing for direction of control work in a manner affording maximum protection to persons, property, and desirable wildlife.

Bureau control work directly contributes to the Nation's economy. Its primary purpose is to prevent, abate, and minimize the depredations of predators and rodents on the products of agriculture and industry, and to contain infestations of predators and rodents bearing diseases threatening man and his livestock. Progress in both the technology and scope of control work is continuous to keep pace with the mushrooming human population and its increasingly specialized interests; with rising standards of agricultural productivity and sanitation; and with increasing production costs and marketing competition. Predators and rodents affect human interests unequally. Bureau control work is permissive by the landowner and is largely confined to areas of serious economic depredations by the cooperative nature of control projects. In practice, the economic considerations of problem areas limit action to establishing and subsequently maintaining acceptable degrees of animal control. Progress is measurable in decades rather than year by year.

Predator- and rodent-control work is conducted by the Bureau under some 58 cooperative agreements with 60 major State agencies in 37 States. Under these primary agreements are some 300 secondary agreements with counties, associations, cities, and public agencies directed at minimizing a wide range of specific local depredations. Approximately two-thirds the cost of cooperative control work is financed by non-Federal cooperators who now contribute about $3¼ million annually to the more than $5 million of cooperative control work. These cooperative funds are provided by State and local appropriation, apportionments, tax levies on livestock and substantial contributions by individuals and associations of individuals. Since the greater part of cooperative control work is borne by non-Federal funds, the increase from $2.7 million of cooperative control funds to $3.2 million in fiscal year 1958 is an indication of the progress and scope of the Bureau's cooperative-control programs.

The Bureau engages also in cooperative-control work of the extension type. In this phase the Bureau provides technical control methods guidance and assistance but others assume administrative responsibility for project operations. Control-methods demonstrations, radio and TV releases, bulletins and animal population surveys are directed at a wide range of animal depredation problems.

The principal control activity of the Bureau is concerned with the larger predators—coyotes, wolves, bobcats, and mountain lions; and range rodents—prairie dogs, ground squirrels, pocket gophers, porcupines, and mice in the western public-land States. Most of these operations date back to about 1915 for the protection of livestock and game, feed and forage for livestock, reforestation, and agricultural crops. The resulting projects are now established coordinated cooperative-control operations on both public and private lands.

The sheep industry of the West is dependent on effective predator control since its present economy cannot absorb the 10 to 15 percent predation losses common some years ago. Because predators are so adaptable, control-methods research is necessarily continuous to keep predation losses at an acceptable minimum.

Predator control in Alaska is largely directed at minimizing critical wolf predation on game as it develops in specific areas. The Bureau is currently emphasizing further wolf-predation studies on the range of the Nelchina caribou herd.

Mice are frequently an absolute limiting factor on reforestation. Direct aerial or ground seeding is much less expensive than planting seedlings, but is rarely successful unless mouse activity is limited. National forest administrators as well as private timber interests are active cooperators in mouse-control projects.

Economical pocket-gopher elimination on national forests and in irrigated sections has proven extremely difficult because of the immense amount of labor required. Less expensive control methods are currently the subject of intensive cooperative research.

Stockmen leasing public and private rangelands cooperate with the Bureau on prairie dog control projects to restore the stock-carrying capacity of infested

grasslands. Increases of as much as 25 percent in the stock-carrying capacity have followed on control of heavily infested areas. The vast continuous prairie dog towns of frontier days have been broken up but scattered infestations still remain where elimination is uneconomical, undesirable, or unwanted. Prairie dog-control work requires constant maintenance.

A wide range of business interests are confronted with damage by rats and mice which gnaw, burrow, and contaminate with filth. The food industry is particularly concerned with rat and mouse damage on a national scale under rising national-sanitation standards reflected both competitively and by the Food, Drug, and Cosmetic Act. Grain sanitation to prevent both direct loss to rats and mice as well as contamination from excreta, hair, and body parts is reflected in specific organized projects in grain-producing States. The grain-handling chain from producer to processor to distributor are all subject to rat and mouse losses stemming from exposure to rodent populations over which the industry has no direct influence and to which organized control projects are the only effective answer. In one State the renewal of uniform grain-storage agreements recently hinged on establishing effective measures to control rodents to maintain the sanitary condition of stored grain. The Bureau is cooperating with State grain sanitation committees which represent grain producers, handlers, transporters and processors, and related business and community interests. Community and county grain sanitation programs and State programs utilizing Bureau rodent-control techniques are recent developments.

As the human population crowds animal populations, the diseases transmitted or caried by predators and rodents or their ectoparasites are of increasing concern to the Bureau. Of the many diseases to which wildlife is subject, rabies is now one of the most important. With progress in treatment of human rabies and mass vaccinations for canine rabies, the largest reservoir now exists in the Nation's wildlife, especially in the carnivores—primary raccoons in southeastern coastal areas, foxes in the East and South, and skunks in the Midwest. Recently, discovered occurrences in bats has added an unknown factor in spread of the disease. A major portion of Bureau control work in the Eastern-Southern States is devoted to assistance in containing fox rabies by drastically controlling the fox populations of infected areas to restrict the transmission from animal to animal. Rabies outbreaks involving most of the carnivores in some degree become emergency local problems at unpredictable intervals in almost all the States. Following Bureau action on the Great Basin outbreak of rabies in coyotes in 1915, aggressive economic coyote-control programs have largely contained coyote rabies in the Western States.

Another special field of control concerns mouse damage to orchards. Recent Bureau developments on trail builders for placing mouse bait and new devices for preparing specific rodenticides contributes materially to successful control by orchardists in the Eastern States.

Depredating and nuisance birds, although neither predators nor rodents, are a growing Bureau control problem. The Bureau is more and more frequently called upon for aid in dispersing and removing starlings, sparrows, blackbirds, pigeons, and other birds. Technical advice and demonstrations of non-game-bird control methods are a phase of grain sanitation, closely allied with other control problems of orchardists and grain farmers in many sections, and with the rat and mouse control programs of the business areas of many cities. Aircraft, both in storage and flight, have their own new and peculiar bird hazards. Considerable progress has been made in flock dispersal methods by the saturation use of exploders and exploding shotgun shells. However, such devices frequently only move and expand the problem.

Conservative progress in modifying cooperative administrative arrangements provides for coordination of the control efforts of all interested agencies in several States. These modifications eliminate duplication of responsibility and control operations which previously existed. New cooperative arrangements with the game departments of New Mexico and South Dakota and with the departments of agriculture, game, and extension in Oregon are examples.

Problems

Bureau control problems are basically concerned with three factors: (1) continuously changing land use and sensitivity of animal populations to these changes, (2) necessity for adapting controls to the increasing variety of human interests, and (3) necessity for further development of specific control methods for specific animals.

The control of birds is currently a major problem. There is much overlapping of depredating and desirable species. Bird depredations are limiting problems to segments of agriculture and industry and must be met. Current control methods are inadequate and not sufficiently selective.

The economic necessity for keeping food, free of rodent contamination, has only begun. Sanitation or the lack of it now has a real and growing economic bearing on the profits from production. Control methods for rats and mice and the application of these controls at all points where food is exposed to contamination requires considerable administrative as well as technical improvement.

Control of animal rabies depends in a large part on progress in study of the disease itself. At present, Bureau action is limited to containing the disease once an outbreak occurs. Although an estimated half million people suffer animal bites each year and approximately 5,000 take rabies treatment, little preventive control is possible with present knowledge. Losses from wildlife rabies transmitted to livestock cannot be estimated but they are considerable. The ultimate goal is prevention of epidemic rabies outbreaks in animal populations.

The relationship of animals to each other under changing environmental conditions is inadequately understood. Wilderness conditions are gone. Studies on effects of environment must be directed to 1958 conditions. Predator-prey relationships and the unforeseeable eruptions of rodent populations are two important problem areas of effective predator and rodent control.

RIVER BASINS

Accomplishments

From April 1, 1955, to September 30, 1957, the Bureau completed 118 reports on Bureau of Reclamation projects, 372 on Corps of Engineers' projects, 138 on hydroelectric projects subject to license by the Federal Power Commission, 257 on Department of Agriculture projects, and 66 special reports.

Several reports of unusual importance were completed. One was prepared for the Secretary of the Interior to assist him in determining the disposition of Federal lands and waters in the upper Klamath Basin of Oregon and California. It set forth the vital importance of that area to waterfowl. Another was written on the Garrison diversion unit in North and South Dakota. That report included a plan for development of some 62 wildlife areas which would compensate to a large extent for waterfowl habitat to be lost because of the project. The areas also would provide new fishing waters and additional habitat for upland game. A part of the Lower Souris National Wildlife Refuge would be flooded by the Westhope Reservoir but would be replaced in the general vicinity. An important new waterfowl management area would be established at the West Bay of Devils Lake.

A third report of unusual interest was written on the mid-State project in Nebraska which is being planned by the mid-State reclamation district. This is the first time that a private reclamation district has requested this Bureau to make a study of its projects. The Bureau's fish and wildlife plan includes the establishment of a Federal-State waterfowl area.

During this period, agreements were executed designating some 341,610 acres of lands at 23 water-development projects as being suitable for use by Federal and State wildlife agencies. A national wildlife refuge was established at one of them.

Bureau participation in the 5 year interagency investigations of the Arkansas White Red River Basins and the New England-New York region was completed during the last quarter of fiscal year 1955. Our representatives served as chairmen of the fish and wildlife work groups of the two interagency committees and prepared the portion of the committee reports dealing with fish and wildlife resources.

The national survey of fishing and hunting was completed during 1956. This survey had been recommended by the International Association of Game, Fish, and Conservation Commissioners (comprising the fish and game commissioners and directors of the 48 States and the Canadian Provinces) and by various conservation organizations. The study, conducted by a private sampling firm, represented a nationwide effort and revealed among other things that 25 million persons spent 500 million man-days and $3 billion fishing and hunting during 1955.

A countrywide inventory and classification of wetlands was completed with the publication of 48 individual State wetland inventory reports and a national summary entitled "Wetlands of the United States." The inventory revealed that our wetlands have been reduced from their original total of 127 million acres to less than 82 million acres, of which only about one-fourth are of high or moderate value to waterfowl. A comparable inventory of permanent waters of significance to waterfowl has been completed for 35 States.

Assistance was furnished the Department of Agriculture in formulating program regulations for the conservation reserve program. This resulted in modification of numerous soil-bank practices to favor conservation of fish and wildlife resources. Three specific wildlife practices recommended by the Bureau have been included in the program.

Efforts by our Bureau under the wetland preservation program stimulated formulation of the save-the-wetlands program of national wildlife conservation agencies and has pinpointed problems in specific areas, such as the prairie pothole region of the Middle West.

A hearing was held in September 1957 regarding the United States Fish and Wildlife Service's proposed withdrawal of 31,000 acres of public lands for the protection of migration routes, spawning grounds, and rearing areas for anadromous fish in the Middle Fork Salmon and Main Salmon Rivers, Idaho. Representtives of the Service, the State and private conservation agencies pointed out that dredge mining operations in the past have seriously altered the physical characteristics of the watershed and that the Service is, in effect, seeking authority to prevent destruction of additional areas of the Salmon River.

Special studies are being conducted at Narragansett Bay, R. I., to determine possible effects which the Corps of Engineers' proposed hurricane control barriers may have upon fishery resources and their environment. Great progress also has been made in improving facilities at Holyoke Dam, Mass., for the passage of shad.

The Secretary of the Interior has approved joint Bureau-California plans, including a hatchery, for the preservation of fish runs in connection with the Trinity River division of the Central Valley project, California. As a result, these facilities, including the fish hatchery, are under construction or in a detailed planning stage by the Bureau of Reclamation.

Nearly 10,000 acres of land have been made available for fish and wildlife management along the Sulphur River below Texarkana Dam. This has resulted from implementation of plans developed by the Bureau of Sport Fisheries and Wildlife in cooperation with the Texas and Arkansas fish and game agencies and the Corps of Engineers.

Stipulations favoring fish and wildlife resources have been included in 24 preliminary permits and 23 licenses issued by the Federal Power Commission. These provisions were requested by the Department of the Interior on the basis of studies made by our Bureau.

Since March 1955, the Congress has enacted laws authorizing construction of 10 water-use projects in which fish and wildlife conservation is a specific function of project plans. All are Reclamation projects. In seven of these, preservation and propagation of fish and wildlife is a project purpose under terms of the act. All 10 of the project plans authorized include measures for fish and wildlife based on Bureau recommendations. Along the same line, pending legislation (omnibus rivers and harbors and flood control bill), contains several projects which include among their project purposes the improvement of fish and wildlife resources or provide specific measures for their conservation.

Problems

Some of the major problems facing the Bureau in its river basins work are indicated below:

1. Lack of adequate general legislative authority for construction agencies to incorporate fish-and-wildlife conservation measures in water-project plans.

2. Lack of adequate time to complete investigations following receipt of engineering data from construction agencies and prior to crystallization and finalization of water-project plans.

3. Lack of authority for construction agencies to acquire land at water projects for fish and wildlife and related recreational purposes. Such lands are essential in most cases to realize the fish-and-wildlife recreational potentials of these projects.

4. Reluctance on the part of construction agencies, public and private, to include project costs for fish and wildlife conservation in their plans. It is axiomatic that fish and wildlife conservation in river-basin development is not free or cheap, though it usually is moderate in cost.

5. Consideration and final recommendation for authorization of water project plans by public-works committees of the House and Senate without full consideration of effects of these projects on fish-and-wildlife resources.

6. The total amount of funds available for the investigation of water-resource projects is very small compared to the program and the funds available to the water-construction agencies. Fish-and-wildlife values affected by these projects are highly important to the public generally. It is difficult for the investigation program of the Bureau to keep pace with these large programs of the construction agencies.

7. Federal subsidies for the drainage of privately owned wetlands valuable to waterfowl present a complex problem in wildlife conservation. These subsidies are a major factor in the destruction by drainage of small water areas in the prairie pothole region of the Dakotas and western Minnesota, which are particularly vital for waterfowl production. Conservation and protection of migratory waterfowl is, of course, an obligation of the Bureau and of all other Federal agencies under laws enacted pursuant to international treaties.

8. More adequate incorporation of fish and wildlife conservation measures in the soil-bank program is needed. This program has great potential for increasing the supply of fish and game in the Nation, but participation in its fish and wildlife phases by farmers is disappointingly small so far.

9. Provisions in most State water laws which relegate water for fish-and-wildlife purposes at Federal projects to a strictly subsidiary status. This greatly complicates the problems of conserving fish and wildlife at water-development projects.

WILDLIFE REFUGES

Accomplishments

Settlement of the Wichita Mountains Wildlife Refuge controversy highlighted cooperation between this Bureau and other agencies not only to safeguard existing refuges but to supplement them through improvement of other wildlife lands. The Wichita refuge issue was concluded when Under Secretary of the Army Charles C. Finucane approved on September 6, 1957, the agreement which he and Assistant Secretary of the Interior Ross Leffler had previously tentatively outlined.

This conservation victory is somewhat tempered by subsequent announcements by the Department of Defense outlining an expansion program involving all lands for several miles west and north of the refuge.

Protection for the tiny key deer moved close to accomplishment, thanks to legislation passed at the first session of the 85th Congress. Sparked by Congressmen Charles E. Bennett and Dante B. Fascell of Florida and by Senator Warren G. Magnuson of Washington, a bill was passed making possible the establishment of a National Key Deer Refuge. The measure was signed into law by the President. Under the law the Secretary of the Interior may acquire "by purchase, donation, the use of donated funds, and exchange for unreserved public lands" not to exceed 1,000 acres for administration as a refuge, though this land cannot be acquired by condemnation. The number of key deer has increased from a low 25 a few years ago to some 125 today, but rapid development of the Florida keys threatens such a drastic change in environment that the deer are believed to be doomed unless some haven is provided. It is hoped that the refuge will quickly become a reality.

In 1956 representatives of the United States Fish and Wildlife Service and the Bureau of Land Management conducted a joint field study for the purpose of resolving the conflict between livestock and wildlife interests on the Kodiak National Wildlife Refuge in Alaska. That study resulted in a proposal to redraw the refuge boundary line to provide for some enlargement of the existing grazing area on the Chiniak Peninsula of Kodiak Island and to close the 1-mile strip to grazing and other nonconforming uses. The United States Fish and Wildlife Service proposed that there be a buffer zone of 1 square mile established around the existing villages within the 1-mile strip which would provide sufficient land to meet the foreseeable needs of the community.

Plans have been made to relocate the 1 grazing permittee now operating within the 1-mile strip. An order adjusting the refuge boundary in accordance with the findings of the joint field study is now going forward. The boundary changes

as planned will not result in any significant loss of bear habitat; however, there will be opportunities for further expansion of the livestock industry. An agreement was reached on these adjustments, and the 1-mile strip in the refuge was closed to grazing.

The Holla Bend National Wildlife Refuge, a potentially great waterfowl area in Arkansas, long sought by the Bureau of Sport Fisheries and Wildlife, was acquired from the General Services Administration. This area, containing 4,468 acres, is a shield-shaped island in the Arkansas River about halfway between Little Rock and Fort Smith. It will be developed into a wintering ground for Canada geese and ducks.

In the 1930's an 1,800-acre impoundment known as Buffalo Lake was developed on a resettlement project near Canyon in the Panhandle of Texas. This lake has become a very important waterfowl area, and because of its great value as a feeding and resting ground steps have been taken to transfer the project from the Department of Agriculture to this Bureau for development and management as a national wildlife refuge. This project will meet a critical need in the flyway-management program.

A cooperative agreement entered into this year by the Bureau of Indian Affairs, the Bureau of Land Management, and this Bureau provides for classifying wild reindeer as a game species subject to the Alaska game laws, thus providing for a means of keeping feral herds in balance with their range. Herds under native management continue to be classed as private property.

The United States Air Force and the United States Fish and Wildlife Service signed an agreement establishing an Air Force-wide fish and game conservation program. Many airbases in the United States and its Territories are located on vast reservations where fish and game are plentiful. With the program as now planned, the Air Force hopes to join with local, State, and Federal conservation organizations in the protection and management of wildlife. This Bureau will aid the Air Force by providing within the limits of available funds and personnel, technical assistance in preparing fish and wildlife development and management plans, and related services.

A wildlife management survey of Air Force installations now in progress will be completed in 1958. This represents a joint effort with personnel from both the Air Force and the Bureau of Sport Fisheries and Wildlife cooperating. The survey has included demonstration tours to airbases on which outstanding demonstrations of wildlife management have already been accomplished. One of these was to Eglin Air Force Base in Florida, which includes over a half million acres.

A notable milestone of achievement is the Migratory Bird Conservation Commission's approval of the Bureau's proposal for conducting refuge acquisition on the basis of an approved schedule. Under this new plan the Commission considers an entire project proposal which, if authorized, allows the Bureau to proceed as rapidly as funds and other circumstances permit toward acquiring all lands within the purchase boundary. Heretofore, it has been required that individual tracts be submitted to the Commission for approval.

The many demands on the time of the Commission members and their numerous responsibilities have made it difficult to schedule meetings. Thus, the original procedure resulted in prolonged and costly delays in the acquisition of lands for the migratory-bird-management program.

The action of the Commission will serve to streamline the Bureau's land-purchase program and aid materially in bringing into public control wetlands vital to the protection, enjoyment, and use of the migratory-bird resource.

Problems

Preservation of wetlands essential in the management of the continental waterfowl resource continues to be the most pressing problem facing the Bureau. Of the original 127 million acres of wetlands it is estimated that over 45 million have been drained or otherwise destroyed, and of the remainder only 37 million acres are of significance for waterfowl. At the present time wetlands are being destroyed at a greater rate than the conservation agencies are able to acquire and develop waterfowl habitat. Farm drainage in the prairie pothole region of the United States, the greatest waterfowl-breeding ground in our country, has increased many fold during the past 15 years. Statistics reported by the Department of Agriculture indicate that nearly a million acres of duck-breeding habitat in that region were drained during the 12-year period 1943 to 1954. During this period potholes were destroyed by drainage at the rate of about

32,000 per year. Elsewhere wetlands have been destroyed through canal construction, drainage for mosquito control, industrial expansion, and the building of highways.

An inventory of wetlands conducted in cooperation with the State conservation departments and completed in June 1954 revealed that as of that date there were only about 9 million acres of wetlands remaining that have high value for ducks and geese. An additional 13.6 million acres were found to have moderate value.

Preservation of waterfowl-breeding habitat in the prairie pothole region of 56,000 square miles in North Dakota, South Dakota, western Minnesota, and eastern Montana is of highest priority in the Bureau's acquisition program. In addition there are considerable wintering grounds which must be brought under control to prevent destruction by land-use manipulations. Cooperative studies are underway to determine acquisition priorities and to what extent the States will be able to participate.

The problem is not new; however, the need for action has become more urgent and it is now evident that the degree of success achieved in meeting waterfowl requirements and, in turn, perpetuating the American heritage of public hunting depends upon how rapidly the remaining wetlands of high and moderate value can be brought into public ownership and thus preserved for perpetuity. The waterfowl resource is at the crossroads, and unless the basic habitat requirements for the production, enjoyment, and use of the resource are met the ducks and geese will continue to decline in numbers and the age-old sport of waterfowl hunting will be finished.

The primary function of the national wildlife-refuge program is the protection and propagation of wildlife. The development of lakes and marshes for waterfowl and habitat for other wildlife has provided many collateral benefits, the most important of which is recreation. Wild birds and animals in their native haunts are a strong public attraction, and each year an increasing number of visitors seeks out the refuge properties to observe and study nature and take advantage of other recreational opportunities which may be available. The number of refuge visitors has increased from 3,443,000 in 1951 to 7,555,000 in 1956. Boating, fishing, hunting, swimming, and picnicking are permitted to the extent such activities do not limit the effectiveness of the refuge in fulfilling its primary function; however, the refuges are ill-equipped to meet the increasing public use. Roads and trails are inadequate, sanitary facilities are limited at best and often nonexistent. Existing picnic grounds are greatly overtaxed. The public neither fully recognizes nor accepts the limitations of use of these areas imposed because of the needs of wildlife and inadequate funds for recreational development.

Protection of wildlife-refuge lands from increasing pressure for nonconforming uses and special privileges is a continuing problem. A current example which has been highly publicized is the effort of the oil and gas interests to have wildlife refuge lands made available for leasing and development. Pressure for recreational uses such as hunting, fishing, boating, and water skiing in waterfowl-production areas continues to mount.

Under the present reclamation law national wildlife refuge lands in Oregon's Klamath Basin are still subject to withdrawal for homesteading.

There continue to be persistent efforts to divert essential refuge water supplies on which the Bureau has valid filings under State laws. The problem is particularly acute at the Malheur refuge in Oregon and the Bear River refuge in Utah, where attempts are being made to have reservoirs constructed with public funds for impounding the spring flow in excess of present irrigation needs and which, in the absence of public works, cannot be utilized by private interests. If the proposed reservoirs are constructed the streamflow on which wildlife benefits are dependent would cease to exist.

Legal suits involving the allocation of water of the lower Colorado River prevent full implementation of instructions issued by the Secretary of the Interior in 1951 to construct inlets in the dike on the east side of the channelized river below Needles, Calif., as needed to avoid destruction of the Topock Marsh and permit the production of supplemental food for waterfowl on the Havasu National Wildlife Refuge. The loss of waterfowl wintering ground here is a controlling factor in the survival of a segment of the Great Basin Canada goose population. Because of the seriousness of the problem, the Secretary recently ordered the installation of a 36-inch pipe inlet, thus allowing river water to circulate through the marsh.

WILDLIFE RESEARCH

Research responsibilities of the Bureau extend to both game and nongame birds and mammals which may be either migratory or nonmigratory in nature, and which may occur on agricultural, forest, range, or wet lands, either publicly or privately owned. In addition to the study of Bureau problems such as those arising from the national pattern of wildlife refuges, the management of migratory birds and the conducting of predator and rodent control operations, the Bureau, under legislation and cooperative agreements, works on wildlife problems confronting such Federal land-management agencies as the United States Forest Service, National Park Service, and Bureau of Indian Affairs. It cooperates with the Public Health Service on matters related to human health and with the military on animal-control problems. It is looked to by the State conservation departments for technological leadership and consultative service and by the general public for authoritative information on indigenous as well as exotic fauna.

The Bureau conducts studies of the distribution, abundance, life history, and habitat requirements of birds, mammals, and other wildlife except fishes; it investigates such wildlife depletion factors as parasites and diseases and effects on wildlife of pesticides and drainage programs; it originates and refines inventory and habitat management techniques; it develops methods to control birds and mammals which, through their feeding or other habits, cause damage or create nuisances; it coordinates a nationwide cooperative wildlife research and training program supported jointly by the Bureau and the Wildlife Management Institute, and the land-grant colleges and State conservation departments of 15 States and Alaska; it operates a bird-banding laboratory which processes and maintains bird-banding records for the entire country; and in conjunction with the United States National Museum it maintains extensive reference collections of bird and mammal specimens and provides taxonomic services valuable to organizations, institutions, and interested individuals.

Accomplishments

Some of the accomplishments in recent years are listed below according to the following broad categories of research.

(*a*) *Wildlife population and distribution studies.*—Emphasis in this category is on migratory birds—particularly waterfowl and other game birds such as the mourning dove. The number of these birds banded in recent years has increased rapidly and the statistical analyses of the recovery records have provided much information on bird distribution and flight patterns of use in formulating migratory game bird hunting regulations. Such work has made possible the mapping of the distribution of the canvasback duck, showing its abundance on breeding and wintering areas and the proportionate dispersal of populations of other waterfowl species produced in the important prairie province breeding areas of Canada to each of the four waterfowl flyway management areas of the United States.

Taxonomic studies have aided in determining the geographic races of mourning doves represented in the hunters' bags, thus revealing the relative importance of production areas. Considerable progress has been made in preparing a comprehensive report on the status, ecology, and management of the white-winged dove. Two additional reports of importance in this area of research are in press and will appear in the Service's North American Fauna series of publications. These are the Birds of Maryland and A Biological Survey of the Aleutian Islands. The standardization and coordination of a system for color-marking birds has facilitated research on their local movements and migrational habits.

Work on mammals has included the preparation of a monograph on the bobcat, a species which in some western areas is assuming increased importance as a livestock predator. A survey of the mammals of Alaska is underway.

(*b*) *Studies of wildlife depletion factors.*—Research designed to determine the significance of disease as a decimating factor in wildlife populations and methods of combating it have resulted in (1) determining that trichomoniasis, a protozoan infection of the throat, was causing extensive losses of mourning doves, particularly in the Southeast, and that infection could be caused by contaminated food and water as well as by direct contact between parent and offspring; (2) knowledge that nutrition and habitat conditions play an important role in mortality of Canada geese infected by gizzard worms and other parasites; (3) finding that aspergillosis, a fungus disease of the respiratory system of waterfowl, was caused by inhalation of the infective organism rather than through eating mold, contaminated grain; (4) learning that hookworm infection was only one of several factors causing the loss of thousands of fur seal pups; (5) demonstrating that

botulism toxicity at the Bear River refuge appeared to be associated with uncontrolled reflooding; in fully enclosed test plots no toxicity was found; and (6) a more definite diagnosis of fowl cholera in waterfowl and determining the effectiveness of antibiotics in decreasing mortality rate in affected ducks.

In the field of pesticide-wildlife research, the Bureau has endeavored to determine the significance of insect-control programs as factors in the depletion of our natural resources, and to aid in the development of materials and methods which would combine effective pest control with a minimum of danger to wildlife. Field and laboratory studies have been made to determine the toxicity of insecticides to different species and to ascertain effects of different rates of application. Hazard to wildlife from insecticide application is not confined to immediate kills. DDT and certain other insecticides act as cumulative poisons and their residues remain toxic for years or months. Experiments with penned birds have shown that long exposure to these substances causes a sharp drop in reproduction and survival of young. In one test, less than 10 percent of the chicks lived to maturity, even though they were fed insecticide-free diets. Insofar as comparative toxicity is concerned, methoxychlor, which is equivalent to DDT in insecticidal activity, was only 0.1 to 0.2 times as toxic to birds. Other commonly used pesticides similarly compared were found to rank as follows: Strobane, 0.4 to 0.5; chlordane, 10 to 15; heptachlor, 15 to 20; dieldrin, 20; lindane, 50 to 100; endrin, 100; and aldrin, 200. Results of these studies have shown that hazards of insect-control programs can be minimized by controlling rates and times of application, avoiding pollution of streams and ponds, and use of low toxicity materials wherever possible.

(*c*) *Studies of wildlife management improvement methods.*—The primary objective in this field of research has been the development of more effective ways of managing wildlife through the manipulation of its habitat. For example, studies along the Atlantic coast indicated practical ways of correlating mosquito control with waterfowl habitat improvement. The creation of marsh impoundments with stable water levels useful to waterfowl and fish resulted in production of fewer nuisance mosquitoes than in comparable unimpounded marshes. Experimental impoundments have led to procedures for the creation of waterfowl habitat in woods, swamps, and waste areas. In other studies, low quality vegetation has been converted to useful food and cover plants through the manipulation of water levels and through the application of chemical herbicides. Formulations and rates of application have been worked out for the control of several noxious aquatic weeds.

Biologists cooperating with public land management agencies and private industry devoted considerable time to wildlife problems peculiar to forest and range lands. One conclusion has been that timber-stand improvement activities, if they result in the elimination of mast-bearing trees to make room for pine reproduction drastically reduce the carrying capacities for such species as squirrels and turkeys. Another study illustrated that herbicides could be used to control the growth of browse species for the benefit of deer.

Additional information has been gathered on the biology and status of the exotic nutria in the gulf region and of the sea otter in Alaska.

(*d*) *Control methods research.*—A leaflet outlining methods of controlling blackbird damage to corn was issued during the past year as was a bulletin summarizing several years of study on blackbird damage to Arkansas rice fields. Development of a multiple-exploding shotgun shell for use as a bird frightening device was completed. Two repellents tested on birds causing damage to tree seeds and sprouting corn gave promising results. Biologists working on a cooperative project with the Department of the Navy at Midway have discovered that leveling of sand dunes and brush along the runways eliminates air currents favorable to soaring of albatrosses and thus reduces hazards to aircraft and military personnel resulting from aircraft collisions with these birds.

The commercial development of a low-cost netting for placement over blueberries and other small fruit crops is now undergoing tests and appears to be a very helpful means for preventing bird damage to these valuable products.

Research in cooperation with industry revealed that a repellent chemical (VC3–100) was helpful in preventing costly rodent damage to stored foods and military supplies. New anticoagulant rodenticides (PMP and Diphacinone) were tested and shown to be very effective in the control of rats. Repellents developed at the Denver Wildlife Research Laboratory have saved timber growers thousands of dollars because of the protection afforded tree seeds and seedlings against damage by rabbits and field rodents.

(*e*) *Cooperative wildlife research units.*—The cooperative wildlife research unit program, first established in 1935 in cooperation with selected land-grant colleges, State conservation departments, and the Wildlife Management Institute, provides a source of technically trained manpower for the wildlife conservation field and accomplishes extensive research on a variety of problems. By the end of 1956 school year more than 2,500 students had graduated from unit schools. During calendar year 1956 a total of 153 publications based on unit research projects appeared in print, bringing the number of such publications to more than 2,600.

(*f*) *Foreign game introduction program.*—Six species of game birds from Europe and the Middle East have been selected for trial release and about 7,000 birds have been trapped, quarantined against disease, and sent to 9 States for liberation. Three new kinds of pheasants, climatically suitable to the South and Southwest, have been procured and placed on State game farms for propagation.

Problems

The numbers of unsolved wildlife problems are infinite and, looking to the future, the Branch of Wildlife Research must anticipate new ones which will accompany the Nation's expanding economy and increasing human population. Leading wildlife research problems will be discussed according to the broad categories already listed.

(*a*) *Wildlife population and distribution studies.*—Efforts should be made to extract from the backlog of accumulated birdbanding records information on the migrational habits and distribution patterns of important game species for which no summaries have been prepared. Additional banding shall be carefully planned and coordinated to fill the gaps of existing information and to clarify the seasonal movements of certain important population segments.

The inventory, or census techniques which are used to measure the breeding populations and production of migratory game birds for the determination of annual hunting season regulations must be refined. The problem is twofold: (1) to improve the accuracy of individual counts and (2) to improve sampling procedures by which large areas can be covered with a minimum of time and expense and yet provide the required degree of accuracy. Methods now in use for determining the annual waterfowl kill by hunters should be improved so as to yield reliable figures for an individual State rather than for a whole flyway, which is now the minimum unit.

Inventory methods and kill surveys for such species as mourning doves, rails, snipes, and woodcock are undeveloped or inadequate and considerable effort should be expended in this direction.

(*b*) *Studies of wildlife depletion factors.*—Parasite and disease investigations of wildlife should be continued with particular emphasis on botulism and cholera of waterfowl and trichomoniasis of mourning doves with the objective of finding practicable means of abating losses.

Pesticide control programs are increasing in size and scope annually. Last year more than 100 million pounds of insecticides were applied by aerial and ground sprays and dusts to approximately 100 million acres of agricultural and forest land. Many insecticides have not been tested for hazard to wildlife and new compounds are appearing constantly. Control programs, such as the one for the imported fire ant in 20 million acres of the Southeast, are being conducted on unprecedented scales with formulations whose effects upon wildlife have not been determined. Three lines of attack are needed: (1) Toxicity studies on penned birds for untested chemicals, (2) experimental applications in the field where it is possible to appraise accurately effects on wildlife, and (3) field inspection of major control operations such as those for fire ant, Dutch elm disease, white-fringed beetles, and spruce budworms.

(*c*) *Studies to improve management methods.*—Agricultural, industrial, and urban expansion is usurping wetland acreages formerly available to waterfowl. Attendant factors such as the spread of weeds and pollution are reducing the quality of the residual habitat. Ways and means must be found of maintaining a reasonable and adequate portion of the waterfowl resource for present and future generations. There are two methods by which this might be done: (1) raising the productivity of remaining areas, and (2) creating new habitat in locations not now being profitably utilized by man. Limitations and procedures can be defined through intensive research. The problem is particularly acute in the historically famous prairie pothole country of the North Central States where drainage for agriculture under the stimulus of federally subsidized programs has been reducing water areas at the rate of 2 to 3 percent annually.

Migrational and wintering habitat is also suffering encroachment and a thorough review of status and availability should be undertaken to pinpoint needs and provide a firm base for acquisition and management programs.

Forest, range, and agricultural management practices are undergoing constant change and intensification. Their effects on the various game species inhabiting these lands need to be evaluated for the purpose of working out modifications, where necessary, that will permit the harmonious achievement of mutual production and conservation goals.

Through stringent regulation and protection, the unique and valuable sea otter has begun to recover its numbers in portions of its former range. The capture and release of seed stock in vacant habitat is viewed as a means of hastening its restoration. The feasibility of such a program should be explored.

(*d*) *Control methods research.*—The demands from the American public for methods of dealing with bird depredation problems are great. Involved are losses to grain, fruit, berry and forest tree-seed crops, unsightly and unsanitary conditions and disturbances in residential and business districts, hazards to air traffic, and a variety of other complaints. Individual farmers have lost more than 75 percent of their crop to birds. The blackbird group is responsible for a major share of the damage and research leading to means of coping with this menace is a major need. Work must be continued on the albatross and tern problem at Midway Island where these species reach nuisance proportions and pose a real threat to life and property.

The demand for methods of dealing with predatory animals and destructive rodents eclipses that for birds. While the damage caused by them may not be as conspicuous to the untrained eye, it nonetheless reaches immense proportions. Predators destroy livestock, poultry, and game animals. Commensal rodents damage foods and packaged goods and spread disease. Forest and range rodents compete for forage and impede reforestation. There are indications that the exotic nutria is extending its range from the coastal marshes to the inland sections of Louisiana and, in the process, is damaging sugar cane and other crops. The developing rodent plague in the Pacific Northwest has deluged the Bureau with requests for information and assistance. To meet immediate needs, additional research is needed on techniques for the control of bobcats, rats, and mice, rabbits, porcupines, and pocket gophers, and the development of chemical repellents useful in the prevention of many types of losses caused by mammals and birds.

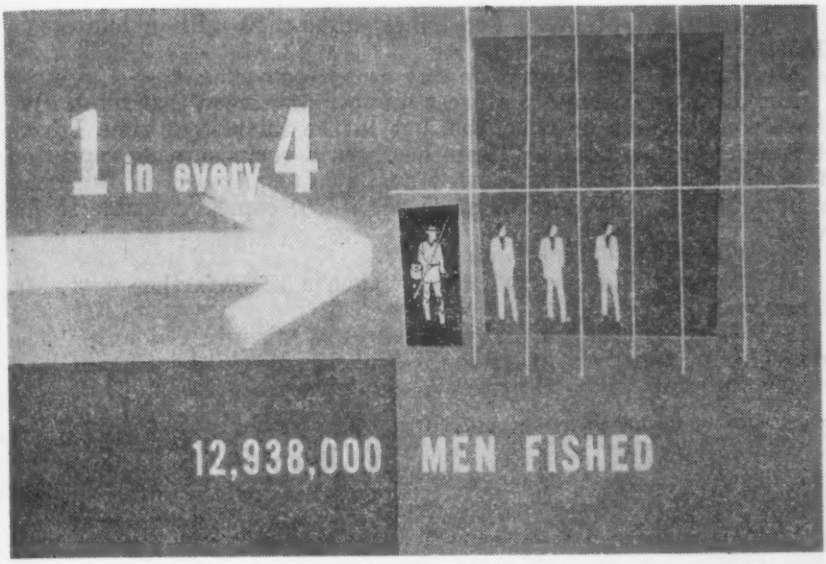
(*e*) *Cooperative Wildlife Research Units.*—In the last year or two, several States, including Louisiana, Tennessee, Washington, and Wyoming have expressed a desire to have Cooperative Wildlife Research Units. Other States with functioning units would like to see fisheries work brought into the program by the Bureau.

Insofar as previous study commitments permit, increased attention should be given to the conducting of research projects on migratory game birds and other problems of especial concern to the Bureau in the future programs of the units.

(*f*) *Foreign game importations.*—The International Association of Game, Fish, and Conservation Commissioners and the individual States have encouraged expansion of this program of importing foreign game species for the purpose of stocking habitats which are becoming unsuited to or from which native species have been extirpated. Resident native game birds are not sufficiently abundant to provide much incentive for hunting in from one-third to one-half of the United States. It is anticipated that at least one additional biologist will be assigned to this project. Additional ecological information, for both this country and abroad, is a recognized need for keeping the program on a sound basis.

Mr. JANZEN. I will start showing our slides immediately and talk along with the pictures, which will save time.

The respective State conservation departments and the Fish and Wildlife Service have been concerned for a long time as to just what the magnitude might be of recreation furnished by Fish and Wildlife, so at the request of the International Association of Fish and Game Commissioners several years ago we let a contract to a national survey organization which made an economic survey. This was financed from Federal aid to the States funds which come from our excise tax on firearms ammunition and sporting tackle. These are some of the findings.



Number of men who fished.

They found that 1 man in every 4 fished. About 13 million men fished in the United States as of 1955.

I am going to run through these rather fast.

Here it shows that fishermen are a hardy lot. They will fish in the winter under severe weather conditions. In fact, winter fishing has become a very important recreation in the Middle West where I was located.

Number of men who hunted.

21168—58——13

One man out of every five hunts; almost 10 million hunters in 1955.

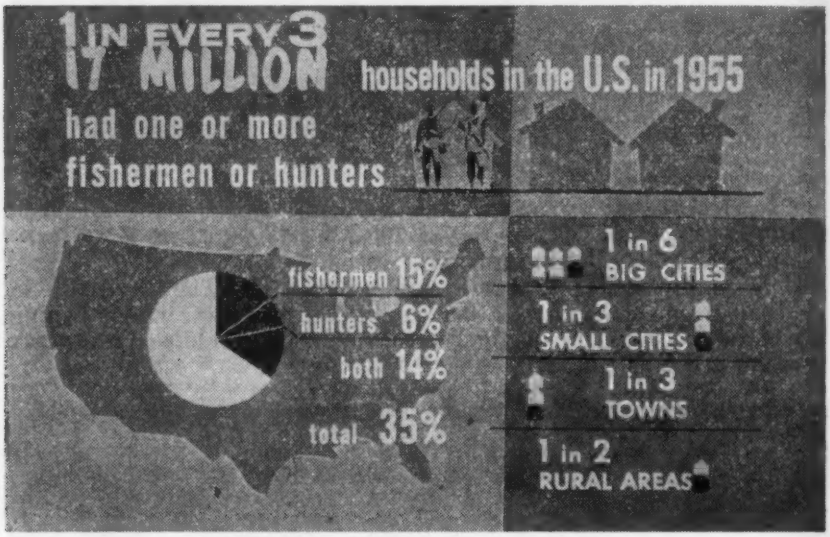
Mr. RIVERS. You don't keep any census on women?

Mr. JANZEN. There are a great number of women that hunt. We have some figures on that, too, but in the interest of time I have left out a lot of details. There has been a very complete report on this that I understand was made available to members of this committee. We will be glad to make additional copies available if you wish.

Mr. GROSS. That isn't Iowa corn?

Mr. JANZEN. No, sir. That was taken a little farther west, Mr. Gross.

This is goose hunting. This picture was taken in Colorado. The goose hunter also has to be a hardy hunter, especially out in the land of that picture where the geese come down very late.



Fishermen and hunters by households.

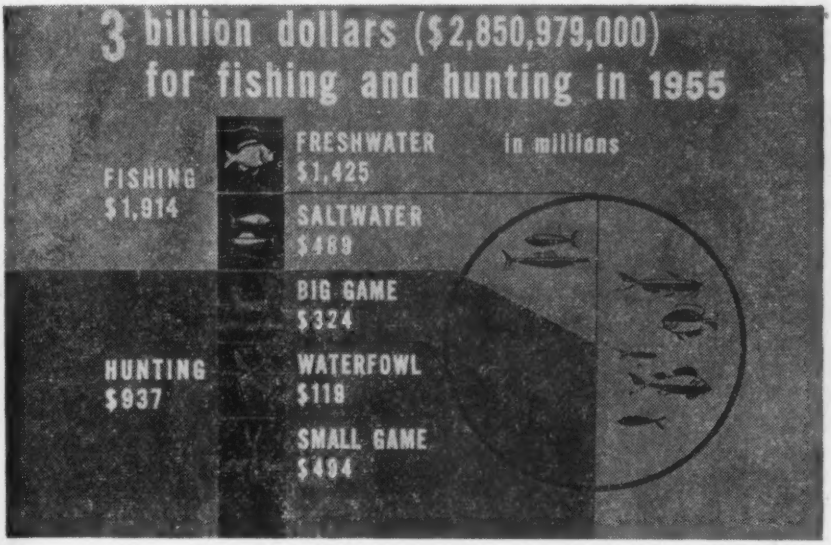
I think this slide is very interesting and significant, showing that 1 person out of every 3 households in the United States either hunts or fishes; breaking this down by different categories of populations, 1 out of 6 in the big cities, 1 out of 3 in small cities, 1 out of 3 in towns, and 1 out of 2 in rural areas.

That was very interesting to us because, as you know, most of our fish and wildlife, especially wildlife, is raised in rural areas.

To the left here you will notice the same information in graphic form. Black indicates hunters and fishermen. Fishermen were found in 15 percent of the households, hunters in 5 percent, both hunters and fishermen in 14 percent, adding up to a total of 35 percent of the households with either hunters or fishermen.

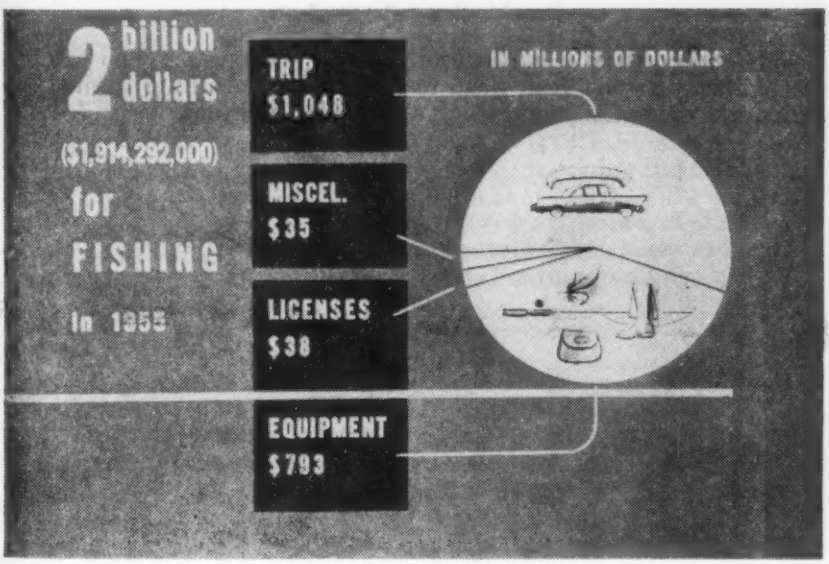
This is a picture of a man and his daughter hunting ducks, and there is a lot of this family hunting and fishing going on, especially in the Middle West where I was located. I think there is probably more general public hunting in that section than here in the East.

Moneywise, we found that fishermen and hunters pay $3 billion a year for the privilege of hunting and fishing, and these figures were very conservative. I studied what they charged off for automobile cost and so forth, and I think the figures are very conservative.



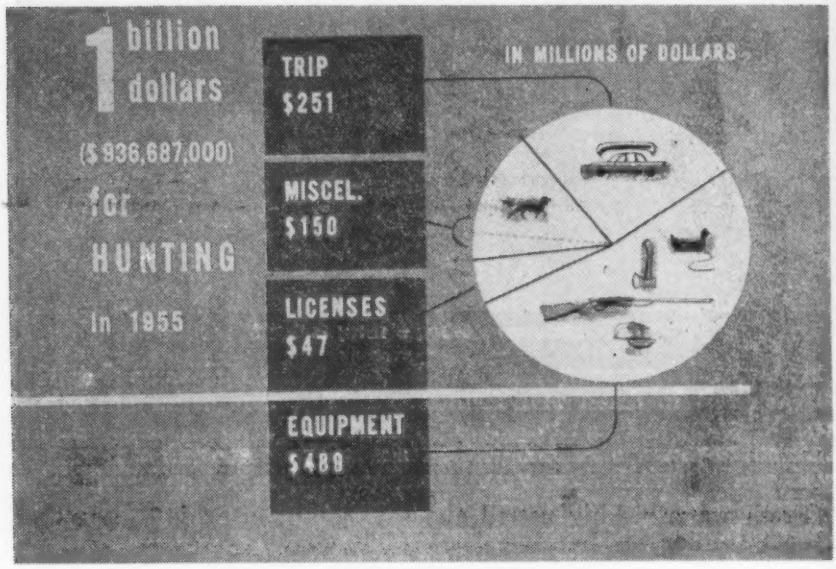
Dollars expended for hunting and fishing.

Fresh water fishing netted about $1.5 billion, fishing altogether about $2 billion, and hunting about $1 billion.



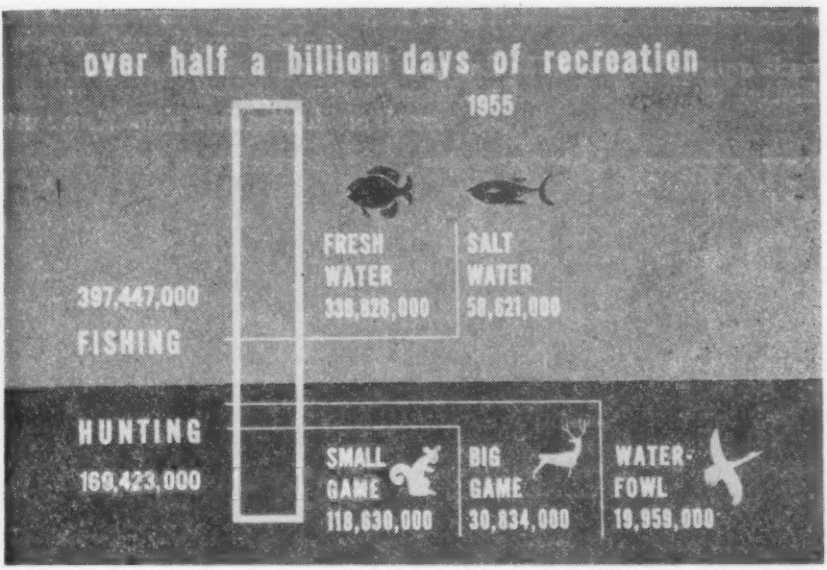
How fishing dollar is spent.

Notice almost a half billion dollars was spent on salt water fishing, $324 million for big game hunting, $119 million for waterfowl, and $494 million for small game. Sometimes one would think that this $119 million on waterfowl must be much greater judging from the interest that we get from the public in this field. I think it is because of the fact that these birds migrate through all the States and so many people have an interest in this group of birds. The next two slides show how the fishing and hunting cost figures break down.



How hunting dollar is spent.

This slide depicts a half billion days of recreation. You can see the figures. I won't read them to you, but again fishing formed the bulk of the recreation, and I think we would expect that.



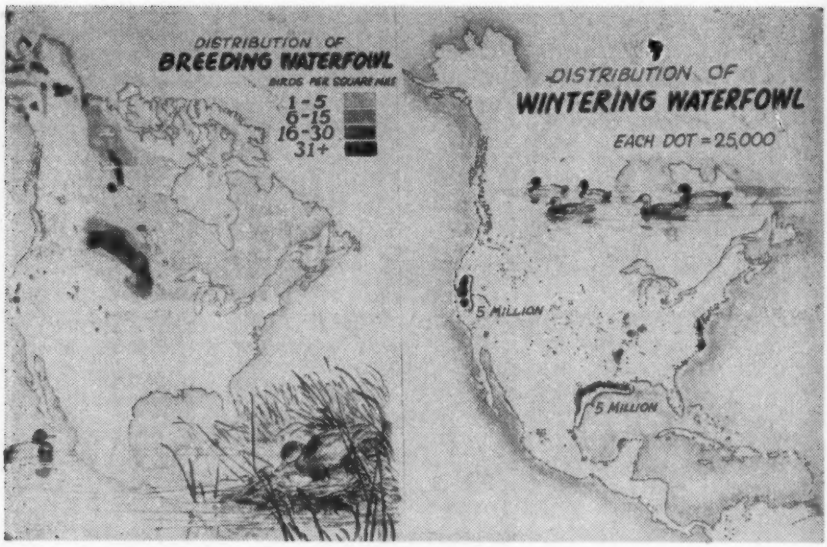
Recreation furnished by hunting and fishing.

However, what this economic survey did not show was the great population of people in these United States who do not hunt or fish, but derive recreation from wildlife through picture taking, nature hiking etc. Children study wildlife in school. They see it in motion pictures. We believe there are more people interested in wildlife who do not hunt and fish than there are hunters and fishermen.

Here you see all sorts of devices used to get better views of birds. Here are some of the closeups you see through your binoculars. This is a wood duck and his mate.

Here are mallards in a secluded spot. Here is a bunch of bluebills, and here are divers that you have here on the east coast, and of course the Canada goose with its brood. They are very interesting and they attract people who come from all over. We have had as many as 20,000 people on Horicon Marsh one day watching the Canada geese in the fall and who never touched a gun.

There are many more man-days of bird watchers and other wildlife enthusiasts at our national wildlife refuges than there are man-days of public hunting on our refuge public hunting grounds.



Breeding and wintering grounds for waterfowl.

I am showing you this map chiefly to give you a little background leading to the discussion of wet-lands preservation. These are the basic maps we use in presenting our information to our waterfowl committee when we discuss waterfowl regulation promulgation. This is our breeding territory in color, but this area here—and I would like to have you keep this in mind—is what we call our bread-and-butter area for waterfowl. It produces in some years up to 70 percent of our total continental waterfowl production.

Mr. TOLLEFSON. How much of that area is in the United States?

Mr. JANZEN. About a third or a little less of this heavy-production area is in the United States. Between here and here [indicating]. You are probably leading up to the next question: What percent are raised in Canada and what percent in the United States?

Mr. TOLLEFSON. Yes.

Mr. JANZEN. That depends entirely upon weather conditions and water conditions. The last few years they have been pretty good over the whole area, but in some years, critical years, we may have only a small part here, or here. There have been years when 40 percent of the ducks raised in this prairie pot hole country, which is our most important area, were raised in the United States. There have been years when it has been less than 20 percent. It fluctuates.

Then our birds migrate and here are our wintering areas. Each year we make a winter inventory on the concentration areas, which gives us some idea following the hunting season as to the number of ducks that are left. Those are our breeding birds that will go back north. Then each spring we cover the breeding grounds to find out where the birds are located, where the birds are nesting, because they do shift, depending on water conditions, and then we follow that with a brood count. That information takes quite a bit of time, but it is absolutely necessary with our heavy hunting pressure to be

sure that our regulations aren't too liberal and, on the other hand, we want to be sure that the public has an opportunity to harvest all those that we can afford to have harvested.

Aerial transects of breeding grounds.

This is how we cover the area and that is why we know it so well. We have done enough sampling through our research work that we now know that this is our most important area. Therefore we give it the most heavy coverage. Most of the work is carried on by the Fish and Wildlife Service, with some assistance from the Canadian Service and some assistance from the States.

Down here the States have taken over most of the work and they are interested in giving intensive coverage in their particular location. Those are strips that are laid out and flown every year. Planes fly at an altitude of about 100 feet. They cover an eighth of a mile on each side of the plane. You can identify the ducks and in that open country you can have a fine count.

Here farther north we fly clear to the Arctic Circle because there are some species that nest that far north.

This is a Grumman Goose, which we found one of the most dependable long-range planes for our use. We have a number of those planes.

Waterfowl flyways.

As a result of our research work and studies over the years, we found that we can pretty well divide production and migration into four flyways. This is the Atlantic flyway, and its principal production area. Here is the Mississippi flyway, and note the Atlantic flyway overlaps its production area. Here is the central flyway and its production area, and the Pacific flyway with its production area.

What we are trying to do of course is, knowing that if we have good production in here, we feel that maybe we could permit more liberal regulations here and contrariwise if production was bad.

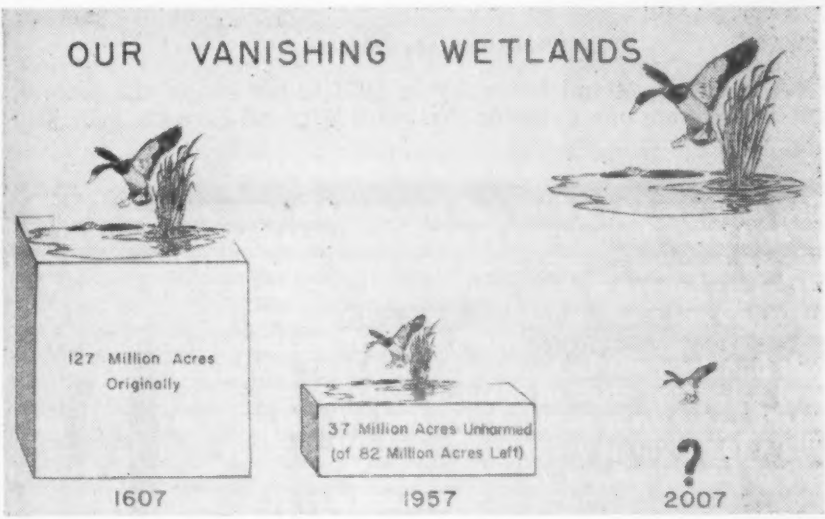
Until about 10 or 12 years ago we had the same regulations from coast to coast and it is obviously not scientifically right or proper from the viewpoint of the public to hold each location to exactly the same bag limits and zones if the supply is quite different in different locations. That is what causes the greatest misunderstanding. We are trying to manage these birds by flyways, and the States and scien-

tists want us to manage them even to a greater extent by individual groups. Keep this in mind in this next slide, as we go to our water wetlands preservation problem.

Mr. ALLEN. Before you leave that, do the various stocks in the breeding grounds change flyways? Is there any evidence of what might be the Atlantic bird one year which might be in the central flyway another year?

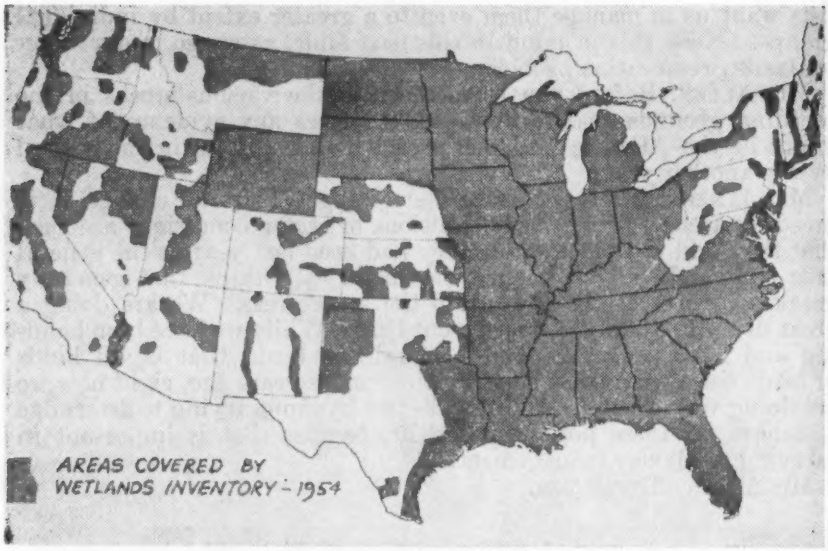
Mr. JANZEN. There is some intermixing. They do change their breeding areas. If weather conditions or water conditions are such that they find the place where they had bred last year or the general area not good they will move elsewhere. We think that generally speaking the birds do go back to the same areas. We are doing a great deal of banding at the present time. While we have been banding and have probably banded 10 million birds, that is, all kinds of birds since we started banding 30 or more years ago, right now we are doing very careful banding, selective banding, trying to determine just how far these populations shift, because that is important in carrying on flyway management.

Mr. ALLEN. Thank you.



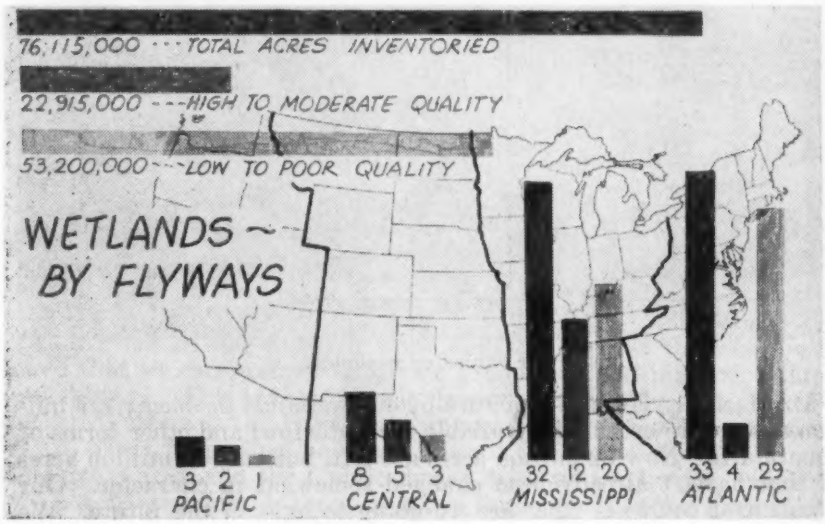
Our vanishing wetlands.

Mr. JANZEN. Here is a picture of our wetlands problem; 127 million acres were originally available for waterfowl and other forms of aquatic life. Now 82 million acres are left, but only 37 million acres of that haven't already been changed somewhat in character. Our problem of course is what are we going to have in the future. We know that the drainage work has been greatly accelerated in the last 10 years on areas that we thought would never be affected. We are especially concerned about the production areas in the prairie section in the waterfowl breeding area that I talked about and also in wintering areas and some of the critical migration areas.



Where wetlands are located.

We made a wetland inventory in 1954 to try to get the picture, just where were our wetlands that were left, and here are generally where our wetlands are.



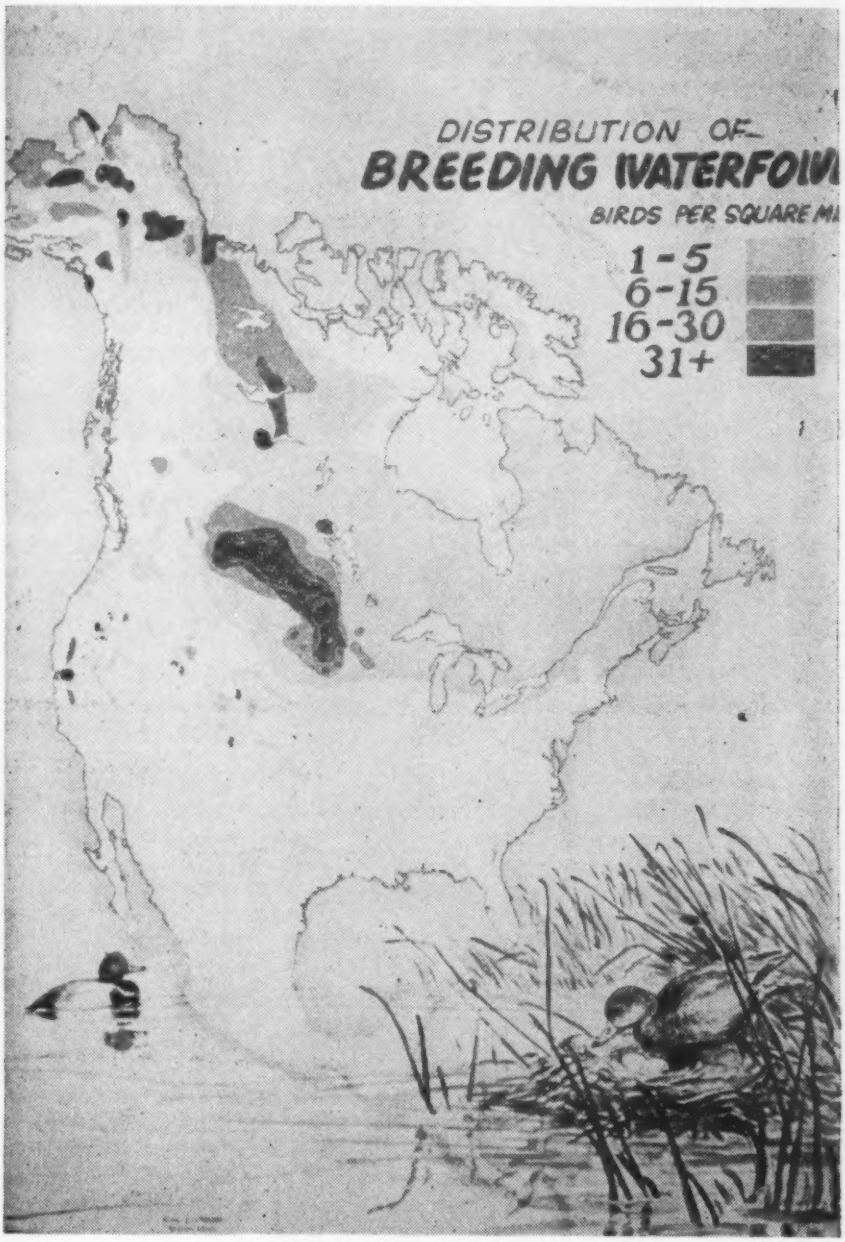
Wetlands by flyways.

This slide will show you the amount of wet lands by flyways: Atlantic flyway—this is what is significant—high to moderate quality. We have quite a bit of wet lands on the east coast, but our high-quality wet lands are very small.

In the Middle West we have more high-quality wetlands. We also have more wetlands generally speaking, a considerable amount, but

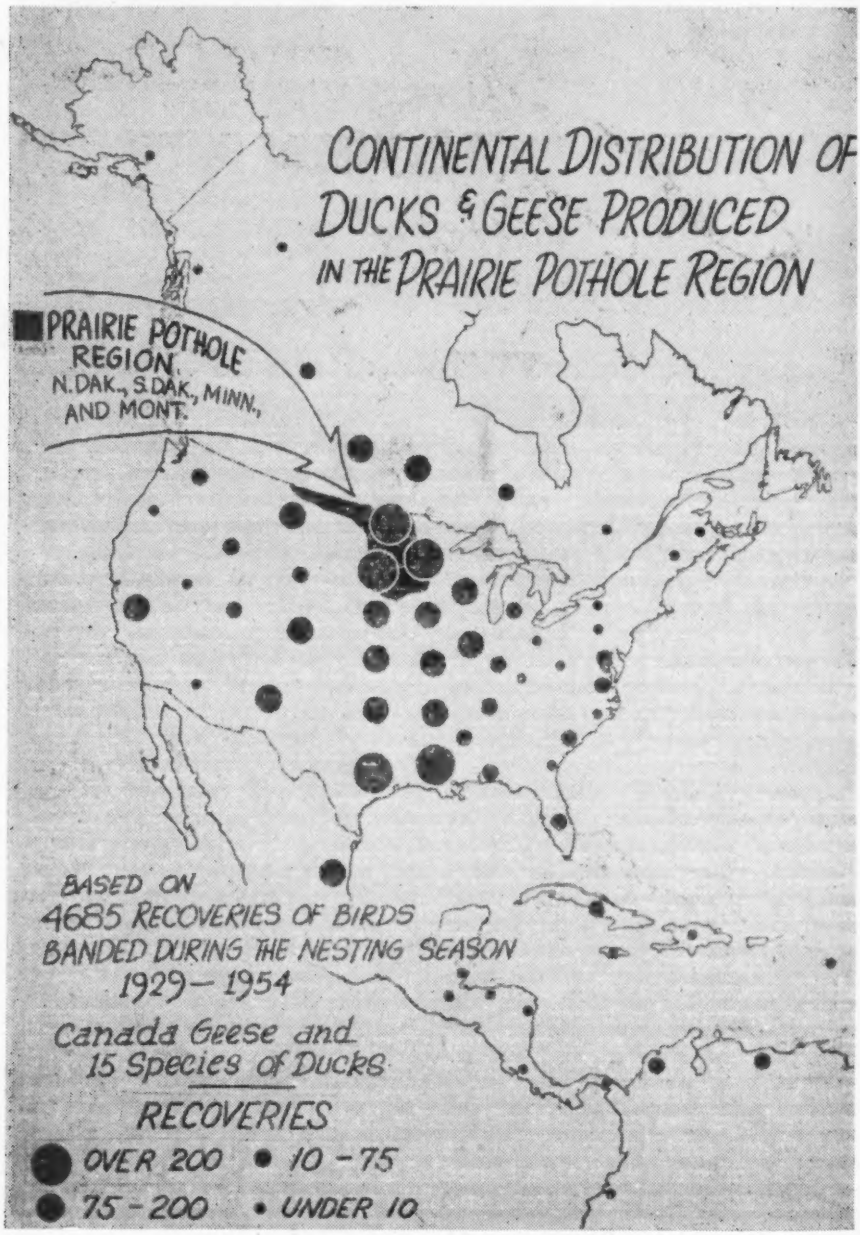
we also have a large population of birds in that area, and as we move west, we have less and less.

On the west coast our critical area is in California, because there practically all the wetlands have already been converted to agriculture and that is the big problem there.



Distribution of breeding waterfowl.

Going back again just to remind you of the production area, I would like to spend a little time talking about potholes. Potholes are water filled depressions in the prairies resulting from glacial action. They are most important to waterfowl production. Too often it is not very well understood what we are talking about when we talk about the pothole wetlands area.



Distribution of waterfowl produced in pothole region.

This slide shows the continental distribution of ducks and geese produced in the prairie pothole region in the United States. That is just from the United States portion. Canvassback redheads, and a good percentage of bluebills that migrate down the east coast are raised in the prairie section. Widgeon and some of your other dabbler species also migrate over this route. Mostly east coast black ducks and greater scaups are raised up in this section.

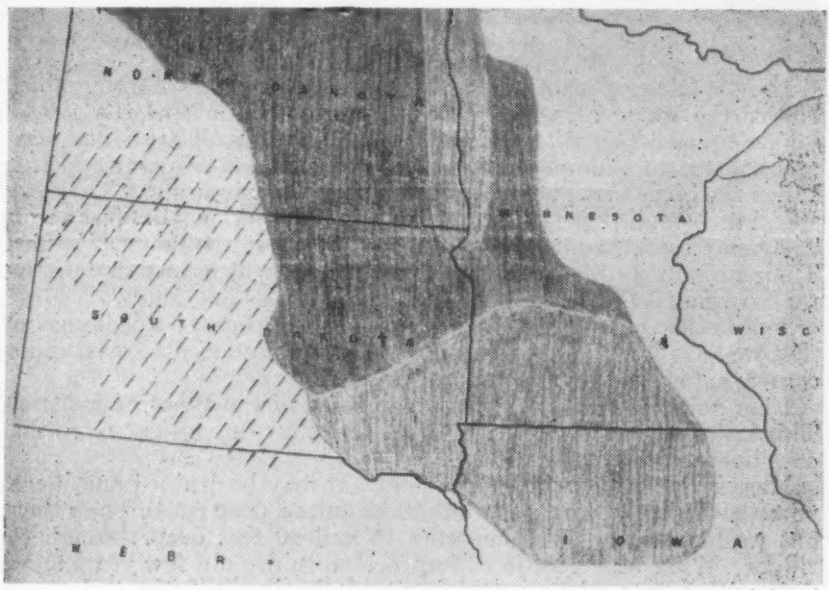
Again you will note that this production area that we are talking about furnishes a great deal of hunting for these States. Recoveries have shown it to be of important value to two flyways and of some value to the other two.

Mr. TOLLEFSON. Mr. Chairman, could I ask the witness, What do you mean by recoveries?

Mr. JANZEN. When we say recoveries we mean banded birds that have been killed by hunters or retrapped.

Mr. TOLLEFSON. Thank you.

Mr. JANZEN. Our problem first of course is to band the birds, but the second problem is to get the bands back so we know where the birds finally ended up.



Remaining prime waterfowl production areas in the United States.

This slide shows the area that remains of original high quality production area, and what has been practically lost already. This area was drained for agricultural purposes. This whole area was originally excellent production area, just as good as this area farther north in Canada, only not as large as the part in Canada.

Typical prairie pothole country.

Here is an aerial shot of some of the country we are talking about. Notice the water areas. This continues over much of the 150,000 square miles. You will notice the complex of small areas and large areas. It is this complex that makes for good waterfowl production. When the birds first go north to mate they want isolation. They may spend their mating period around a little wet spot, not 100 feet across. They may then establish their nest somewhere in the lands adjoining. Their brood may first locate on a water area which may dry up, but we have found that these birds will move across dry land to a larger or more permanent area so that in this drought country it is important that we have large areas, medium-sized areas, and small areas, and of course that is what complicates our problem.

I am going to run quickly through some of the types of wetlands. This is one of the larger brood types that may dry up not more than once in every 4 or 5 years.

Here is one in the middle of a field. It may be drained and it may never be drained, because it would take quite a deep cut through there, but we have found drainage cuts 15 and 20 feet deep through the ridges. What was considered impractical to drain a few years ago is now with new modern machinery and the impetus given drainage apparently common practice.

Here is another small pothole right in the middle of a field. Those are very valuable production potholes. That pothole will have probably 1, 2 or maybe even 3 broods of birds. Again here we have one of the larger areas. These are the areas we are talking about when we say we must find a way to preserve them if possible.

Ditching equipment in operation.

Here is a slide of drainage work—a dragline working through the field to drain this pothole. When he gets that one drained there is another one back here and one here which will probably all be drained.

After the ditch is once dug the marsh is gone. That is being repeated at a terrific rate in the Middle West.

This is a new method of pumping electrically. We estimated in a 2-year period several years ago when we made a very careful study of a number of counties that we were losing potholes in that area at the rate of around 30,000 per year.

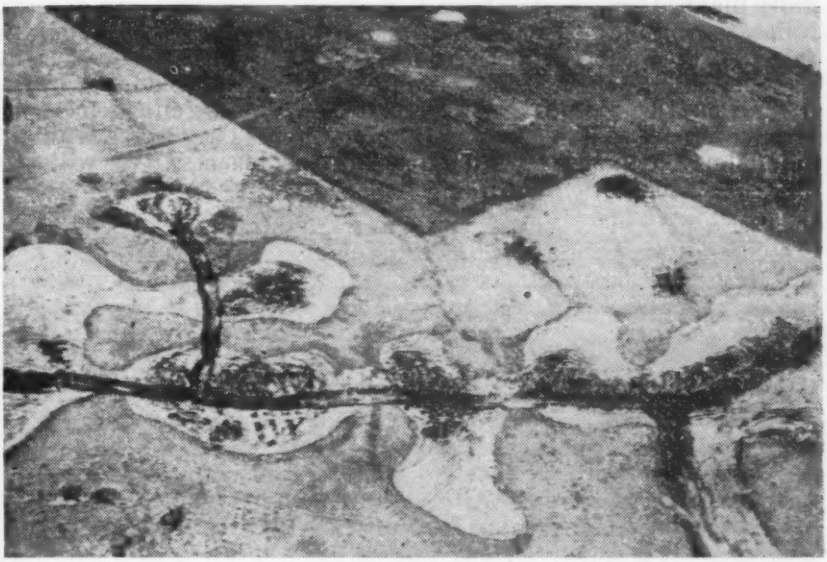
Here you see the tile laid out. It does not necessarily have to be a surface ditch. It may be underground tile and in a few years from now you would never realize that this had been a waterfowl production area.

This is an aerial shot showing some of the typical drainage work. Here you have a pothole that they are draining; again tile laid out for this one.

Potholes and eroded hilltops.

To give you a better impression of what we are talking about here is a slide of the entire complex of potholes with a ditch through all of them. This was a very valuable waterfowl area the year before. It has just been drained and they burned out the cattails and here is what it looks like. That will probably be under cultivation next year. I don't want to leave the impression that this drainage is bad from the viewpoint of agriculture, because the bottoms of these potholes are productive for production of corn, wheat, and other agricultural crops.

Here again is your system of drainage, very recently done.



Drained potholes.

This is another slide showing drainage. You might also note these white hilltops. We had been in hopes that the emphasis on drainage would be shifted to soil erosion control to save the soil in agricultural production and leave the wetlands for production of aquatic life. The water is valuable to that section of the country for other purposes and I think eventually they are going to regret that there was so much drainage work done, because when we go into a dry cycle there will be no water reserve in that section.

Here is an area that hasn't been drained.

This complex has.

Maybe next year it will be this one. Somehow or other we have to find a way to encourage the farmers, through some type of financial assistance, through leasing, acquisition, or other means, to save those wetlands if we want to save waterfowl for the future.

Here is a drained area with the marsh vegetation completely gone. You won't be able to tell that this had been a waterfowl production area in another year.

This is the area in which a wetlands preservation program is essential. The next slide shows this area reduced to this sized area, which we believe represents the best of what is left and on which we would like to carry on an acquisition or leasing program of the most important water areas. We believe this wetlands preservation program is important to a large section of the country.

Now I am just going to run a few slides to show you some of the difficulties. Here is a typical wet area in the middle of a farm. It is almost unreasonable to expect the average farmer to be willing to sell a small wetland area out of his farm. We made a study, a survey, contacted quite a number of farmers through rather care-

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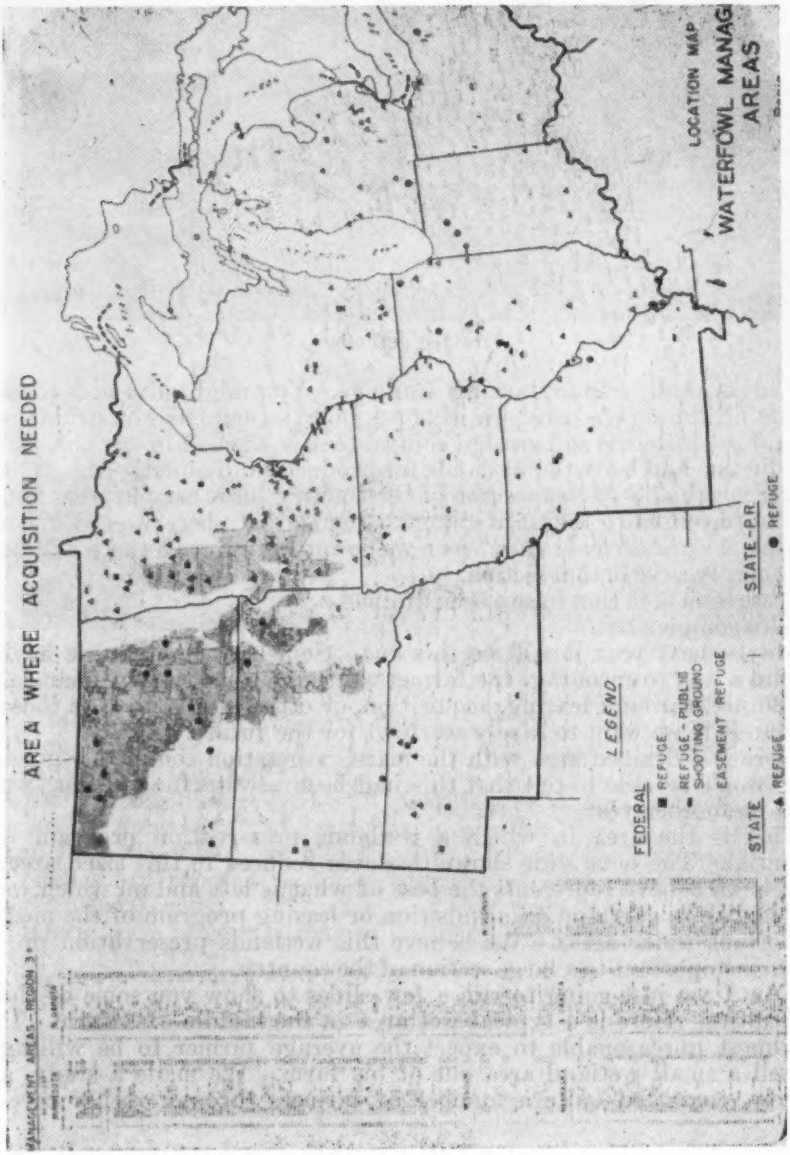
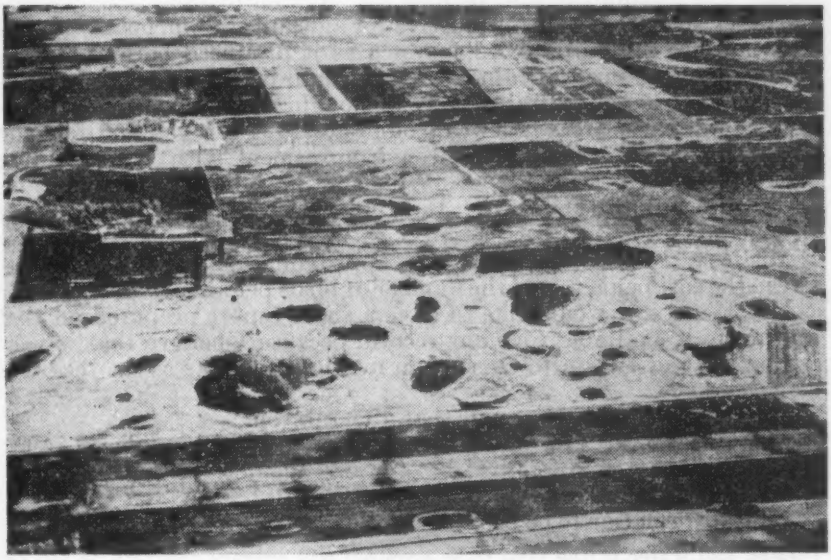
fully planned sampling method, i. e., checked farmers every so many miles, to find out what their reaction would be and what would it take to save these wetlands. We found that generally speaking many were not going to sell fee title to these small wetlands on their farm. Some would be receptive to some sort of a lease or an easement arrangement. Just how many we are not sure. They said "Wait till you tell us what you are willing to do and talk business. We will give you an idea then."



Proposed acquisition areas in pothole production country.

We have a real problem as to how to save these wetlands. I think it will take a combination of leasing and purchase plus other methods on which we are still working. Mainly what we want to do is buy from them the right to drain. They can be kept for grazing. They can be continued in various types of agricultural use. They can be kept open for hunting. There would be no point in closing these little areas to hunting.

I am just going to run through this series of wetland slides very rapidly so that you have a clear picture of the type of areas involved. Some of them are large and some of them are small, but we need both large and small in combination for our production purposes.



Quarter section of undrained potholes which might be purchased in a block.

Here is an area about a mile long and a quarter mile wide with many potholes that has never been touched by a drainage ditch. It is still in grazing. It might be that we could buy that entire tract there, because it is a very fine production area. The original complex of water areas is still there. We might buy this as a block, but generally speaking it isn't practical to try to save the bulk of the wetlands through block purchase.

There is too much upland wanted in this sort of a situation. There are however many situations like that and that is what we would be looking for where block purchase might be practical.

Mr. RAY. May I ask a question.

The CHAIRMAN. Yes, sir.

Mr. RAY. How many birds would you say would be produced on an area of that size?

Mr. JANZEN. It would amount to several hundred birds.

Mr. LANSING PARKER (Assistant Director, Bureau of Sport Fisheries and Wildlife). It would generally run from 2 to 5 birds on an acre of water.

Mr. JANZEN. That wouldn't mean that production over the whole area. I would say there might be several hundred birds to a square mile. I would have to dig back into the records on that, because we have made some studies.

Mr. RAY. What is the value of the land?

Mr. JANZEN. The State of Minnesota has been buying much land of this type. In fact they have been putting most of their Federal-aid money into that kind of purchase. I would say around $25 to $50 an acre. The upland can still be used for grazing or other agricultural purposes, so it can still be productive for agricultural purposes. It still will produce agriculturewise as much as it produced before, but the wetlands would not be drained. That would be our primary requirement, that they not be drained. If we bought fee title we would probably handle those areas like we do our waterfowl refuges, and farm on a lease or a sharecrop basis through agreement with the adjoining farmers or the former owners. We do not have heavy concentrations of birds on production areas. But they are necessary if we are going to continue waterfowl production.

Mr. RAY. I am reaching for some approximation of the relation between the cost per acre and the number of birds per acre.

Mr. JANZEN. I would like to have a short report prepared on that and make it available for your record, because I believe that is very important and I want to be right in my figures as far as the record is concerned.

Mr. RAY. I would appreciate that. Thank you.

The CHAIRMAN. You will prepare that and it will be placed in the record.

Mr. JANZEN. Yes, sir.

(The information to be furnished follows:)

Land and water of the type to be acquired will average from $25 to $50 per acre. It is anticipated that waterfowl production in the selected type of habitat as contemplated in this acquisition area would run around 300 birds per square mile. It is anticipated that waterfowl research will develop information which will eventually raise the production potentials. It should be added that the land will continue to produce agricultural crops only slightly affected by wildlife-management modifications and the income to the Government from this production will greatly reduce the long-range cost of producing these birds.

Mr. GROSS. What was that last slide? Was that a drainage?

Mr. JANZEN. That is a marsh in a wintering area. I threw that on there to show some of the other types of modern civilization encroachment on marshes. For example, here is a ditch for the purpose of straightening the stream. We might have a channel running down through here for the purpose of navigation. In our wintering areas our problems are quite different. We might have a problem resulting from a flood-control structure that might keep the bottomlands from being periodically flooded and thus destroy the former value of waterfowl.

In areas like this we can buy a block of land and this is a practical method for saving wintering grounds, but on the breeding grounds which consist of small water areas scattered throughout, we are not sure we have a practical method. However, we feel we have to start on some kind of a program and improve it with experience.

Here is a result of navigation. This was taken down in Louisiana, something of great concern to us because it may completely change the character of the wetlands through which these big navigation channels are going. We are making studies of all those types of areas wherever the Corps of Engineers, or Reclamation Service, or other agencies are making major changes in water use. We are making intensive studies to determine ways and means of modifying plans so as to save as much of these wetlands as possible. It is obviously impossible to talk about acquisition of these huge areas, but sometimes ways and means can be found of changing the construction plans.

This slide illustrates a problem that bothers us very much. After the navigation channels are fixed there are additional problems. Maintenance of the channel requires dredging and dumping the silt somewhere. In this particular case you see the construction of a real-estate development on a marsh. They are pumping sand and silt into this area, and along the east coast that encroachment is growing every year. Those of you who are interested in hunting and fishing have probably noticed this. The rate of elimination of these marshes from this region is continuing at an accelerated rate.

I merely throw this next slide on the screen to show that there are many millions of acres of water being created by reservoirs and some of them are quite valuable for fishing and some of them quite valuable for migratory waterfowl. Sometimes their value for waterfowl depends largely on how water levels are regulated and we work closely with other agencies making recommendations to them with respect to wildlife all over the Nation, especially in the West.

What have we done so far for waterfowl management? The next few slides will give you an impression of some of our development work on our national wildlife refuges. This area happens to be in North Dakota. Here we created a large marsh. It is a production area, but it does not take the place of these little wetlands where most of the production is found. There is waterfowl production all through this marsh but the production per acre of water is much less on these big marshes.

We have done a little work on some refuge areas creating more potholes. That we could do even on an area such as I showed you a little while ago. We could create more water areas if we acquired fee title to the land, but generally speaking on our refuges we have big marshes and we have created big dikes in order to cut down the cost of acres of water impounded.

Here is a machine building a dike on one of our waterfowl refuges.

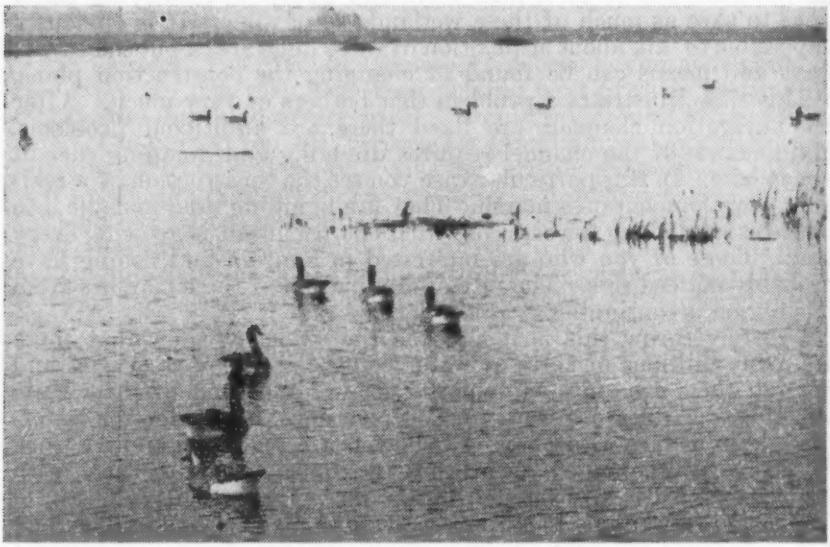
This picture was taken in the Lower Souris, National Wildlife Refuge, N. Dak. It shows a small water control structure, enough to drain the pool. We have overflow structures for the larger floods that might come through.

Again this is lower Souris, N. Dak. About 35 miles of the Souris River Valley bottom was purchased 20 years ago. A series of dams were constructed across the flat bottoms making shallow water pools. It is one of our most valuable waterfowl refuges in North Dakota.

Here are some of the birds taken on the lower Souris refuge. They concentrate during the migration period in the spring and fall.

Here are literally acres of birds. In this case they are mostly pintails and some mallards.

This picture was taken in Nevada down in the Carson Sink Flats where we are diking the flats and using surplus irrigation water to create additional waterfowl habitat. We are generally losing our race to drainage but we are doing the best we can to replace wetlands being lost to drainage and other byproducts of a fast-moving civilization.



Canada geese on Seney Refuge, Mich.

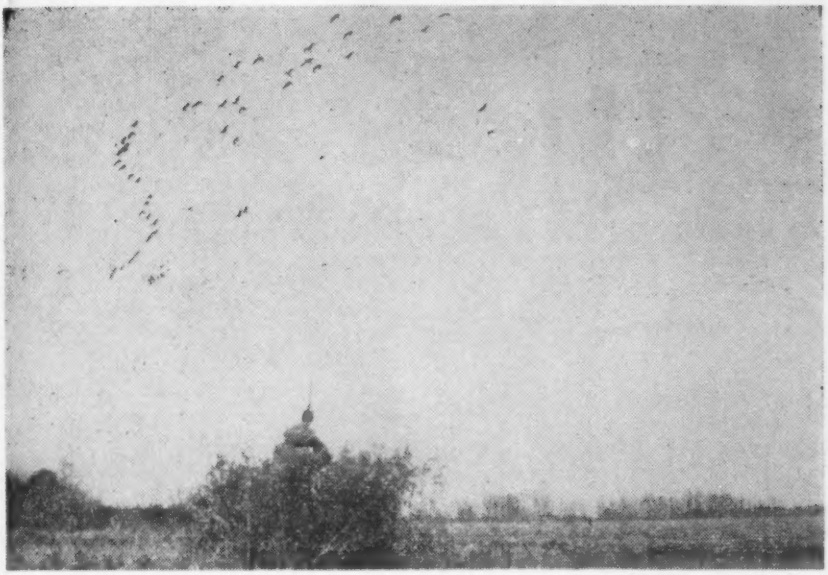
Here are Canada geese. We have no choice but to raise more birds and support more birds per acre of land than we have in the past and we have found that agriculture production is very important and must be properly utilized in connection with wetlands if we are going to do the job. We must handle more birds on less acres and the Canada goose is one migratory bird that flourishes on a good agricultural diet.

This is milo maize, important to Canada geese. This was taken where we had concentration as high as 125,000 of Canada geese at one time.

Mr. GROSS. Do they feed on that?

Mr. JANZEN. Yes, sir. We find we need both the preference food and others. When the food gets a little shorter in supply, they like that.

The land on some acres we purchased was not producing anything. On this slide is shown a land-clearing operation to make it productive. This was taken on Lake Mattamuskeet in North Carolina.



Goose hunting on Lake Mattamuskeet, N. C.

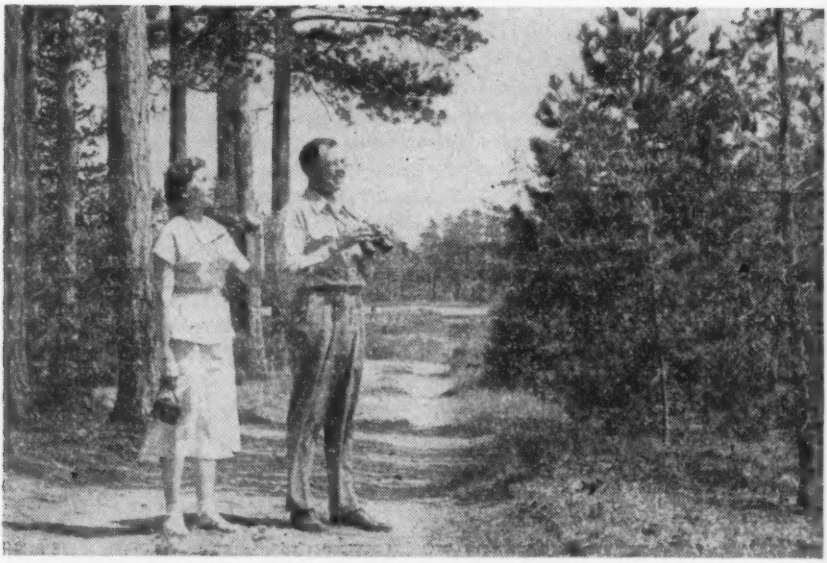
This was taken up in Seney, Mich. We acquired about 100,000 acres of northern Michigan at a very low cost, and constructed a series of dikes, and flooded about 25,000 acres or thereabouts. The State purchased a strip all the way around the refuge of a mile or so in width on which they permit public hunting and it has been, I think, a a striking success. There were no geese nesting there before we started. Now we raise about 1,000 or more Canada geese every year on this area.

Incidentally, this is not one brood. Canada geese have a habit of collecting young and sometimes 1 pair will collect 2 or 3 broods. Their broods will run around 5 per bird.

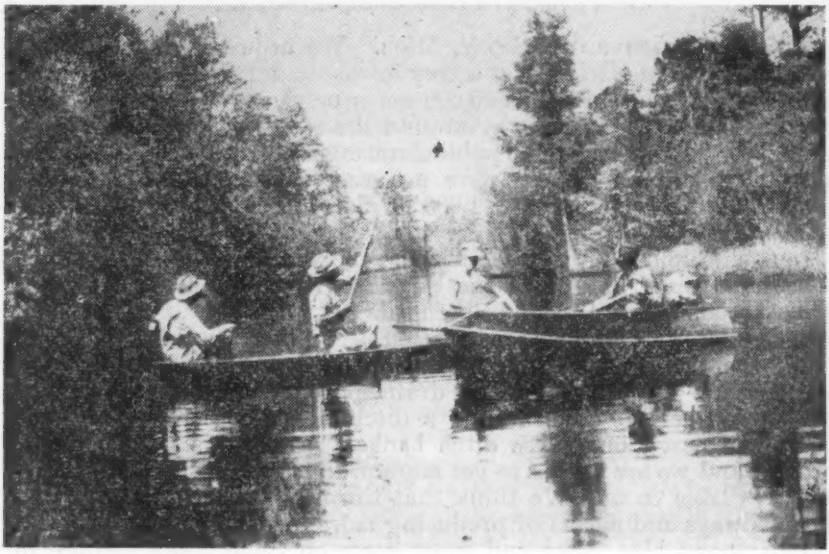
This shows a dike under construction.

We are trying something here because birds like isolation. We call this low-level ditching, not drainage, but in a marsh area that was unproductive. By running a ditch through there we find the birds will nest along these ditch banks. Again this is one of our refuges and we are trying to get more production on the land that is now available to us. We think that through research we will find various ways and means of producing more birds on less acres.

This shows blue geese and snow geese on Sand Lake Refuge in South Dakota.



Bird watchers at Seney Refuge, Mich.



Fishermen at Okefenokee Refuge, Ga.

This is a flock down along the Mississippi River.

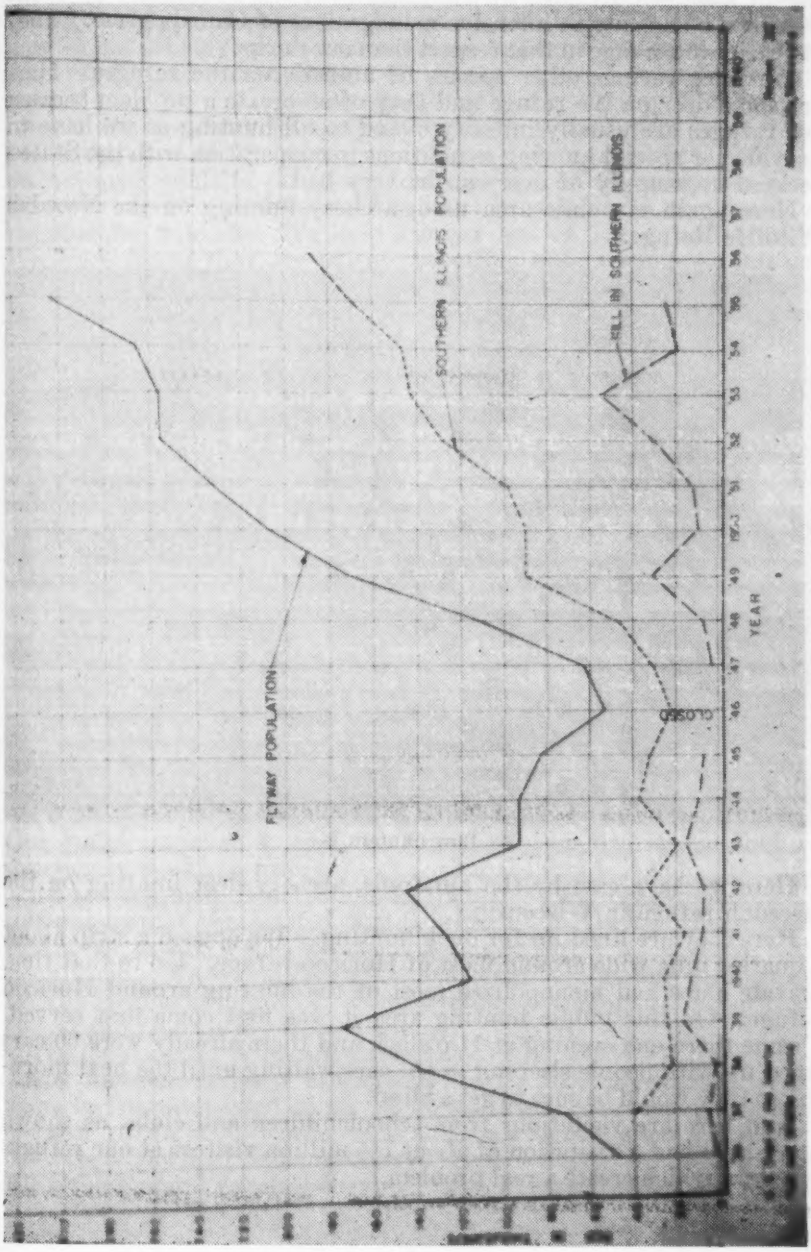
On this slide, you can talk about millions of birds, this would probably come close to it.

This is Tule Lake on the border of California and Oregon, where birds are found in unbelievable concentrations.

Again because our wetlands have practically all been converted to agriculture on the west coast, those are the only places left to the birds.

This is taken on Klamath Lake in Oregon.

This picture was taken in Union County in Illinois, a State development. I put it on the screen mainly to show that the States are working hand-in-glove with us on this program. They are spending at least a fourth or more of their Federal-aid funds, that is, the funds derived from the excise tax on firearms and ammunition, on waterfowl management.



Canada geese population trends in Mississippi flyway.

This slide I am showing to you now shows the ups and downs of the Canada geese population in the Mississippi flyway. We had a low of less than 50,000 geese back in 1946 when we closed the season completely on Canada geese in the Mississippi flyway. Initial stringent restrictions plus the purchase of a number of areas, including the Crab Orchard refuge, resulted in the building up of this flock until now we have over 300,000 in the flyway and over 200,000 wintering in southern Illinois, in the space of about 10 years. It shows what can be done with intensive management of Canada geese. They are easier to manage in that respect than our ducks.

We have various other species of animals on the refuges. Here are some deer on the refuge and they often create a problem because our refuges are usually initially closed to all hunting so we have to provide for special hunting regulations in cooperation with the States, because oversupply of deer can be very bad.

Here again is public area used, archery hunting on the Necedah Wildlife Refuge.

Bow hunters.

Here we have cars by the hundreds, archery deer hunting on the Necedah refuge in Wisconsin.

Here they are lined up for duck hunting. We opened a strip about a quarter mile wide around most of Horicon refuge. Up to that time private clubs had monopolized most of the hunting around Horicon refuge. On this public hunting area it was first come first served. I came there one evening at 11 o'clock and there already were 60 cars lined up with people sleeping in the cars waiting until the next morning so they would be sure to get a blind.

And here are visitations from schoolchildren and clubs, as shown here. We had a visitation of about 7½ million visitors at our refuges last year, which create a real problem.

We have set up many signs so that people will follow the trails and stay out of the restricted areas. We simply don't have the manpower to properly take care of the visiting public.

This picture and the next one are taken at Crab Orchard in Illinois. We have had over 50,000 visitors in 1 day on this Crab Orchard refuge. The lake is the most valuable recreation area in Illinois.

This slide shows the recreation area and picnic tables. That is about the only amount of recreation facilities we provide because we are not in that type of recreation business. When the crowd goes home here is the debris that we have to clean up, as is seen here, and that does require some manpower. We haven't found a way yet to have people pick up their debris when they leave. The policing job is terrific where we have those big concentrations of people.

I throw this on the screen mainly to show agricultural activities on national wildlife refuges. Immediately when we acquire these lands we start to work converting them to make them as valuable as possible for wildlife. We have a great deal of haying and grazing. We have found they are quite compatible with waterfowl management on these refuges. In fact, some grazing is good. It helps break down the heavy cover around the water areas. Our policy is to make that use available to the adjoining landowners at prices competitive with local private charges considering the fact that we do impose special regulations in certain instances, and we have to take that into consideration when we charge them for privileges.

These pictures were taken on lower Souris.

This was taken in Crescent Lake.

This is on Malheur refuge.

This is up in Horicon refuge in Wisconsin. There are grazing and livestock operations all over.

Now we are going to a subject which I promised we would discuss Friday, the subject of law enforcement. I am personally thoroughly in agreement with those who believe in strict enforcement and believe that our regulations are only as good as the enforcement that they get, but I think maybe it is not so well understood that most States adopt our Federal water-fowl regulations in toto and thus are in a position to also enforce migratory bird regulations. They make them their State regulations, so that their State wardens enforce identically the same laws that our Federal men do. We work very closely with the State enforcement officers. We are on their radio hookup. Our radio intercom is tied in with their organization so that we practically work as a team.

As you will note from this slide, there are 4,324 State men and 128 Federal men in the United States, with 24 in Alaska. There are a few areas, as Mr. Leffler testified Friday, where we need some additional help. We would like additional help because our enforcement isn't as good as it might be. Some States don't adopt all of our regulations and we have to enforce them.

The CHAIRMAN. What are those States?

Mr. JANZEN. A good example is North Dakota. This year the State legislature passed an act which made our laws inoperative until October 1. In other words, what their law said in effect is "We will open the waterfowl season the last 3 days in September regardless of what the Federal regulations are." The Federal regulations did not

open the season in any State until October 1 this year, so for 3 days we had to enforce all protection for migratory birds in North Dakota. We took care of that by sending in a number of additional men. Fortunately, at the last minute the Governor also advised his people not to hunt.

However, the act was passed by the legislature and signed by the Governor so it was illegal for the State wardens to enforce our regulations. That is a good example of what may happen.

Some years some of the States have not liked some of our regulations and have just simply quietly issued instructions to their wardens not to enforce certain regulations. Obviously if we are going to promulgate a regulation we must give it uniform enforcement wherever the regulation applies.

Mr. GROSS. You have also had trouble with baiting in Maryland; haven't you?

Mr. JANZEN. We have had problems with baiting in Maryland, in California, in Ohio, in Illinois, and in a number of other places. Sometimes the interpretation of the law is such that we haven't had, you might say, as strict an interpretation as we want. We want to have the same interpretation in all States.

Mr. GROSS. You say interpretation. I would say enforcement.

Mr. JANZEN. You are probably right. Enforcement maybe is a better word for it. Let us say that those who disagree with us say that it is a matter of interpretation.

A question was raised as to what do these agents do during the off season. Our enforcement agents are busy all the time. Their real busy period of course is when the migratory birds are in their districts, but they have off-season responsibilities. In order to get the full personal cooperation of the various State wardens the State wardens expect them to work some with them during the off waterfowl season. For example, here is a slide showing a fish case. On your right was the legal limit. This bunch of fish to the left was illegal, over the limit, for this group of fishermen. This happened to be taken in Colorado. Our men will be working with State wardens on fish and upland game checking during the summertime in return for which the wardens are more than happy to spend a little extra time on waterfowl in the fall. The States and we desire that type of cooperation.

At the same time our wardens are working with the State wardens so they clear up matters pertaining to waterfowl regulation interpretation, and so forth. Also our Federal wardens are sent to Canada in the summertime and work on waterfowl production surveys, our regulation-making material-gathering, up there. They also work on banding. They have to check the many permits that we have. We have propagating, collecting, and other types of permits and they are busy the year around.

Here is a slide showing the checking of big game. Checking interstate shipments of animals taken illegally is an important responsibility of Federal agents. If a deer is taken illegally in a State and shipped across the line or shipped illegally across the State line it becomes a Federal case and our men work closely with the State wardens on that type of enforcement.

I shouldn't probably take up your time on this. One of the regulations which caused quite a furore, and which some of you have probably heard about, was our making illegal the use of electronic calls,

a recording of natural goose calls, in the taking of migratory waterfowl. The hunters through the years have used recorded devices, but they got smart here the last couple of years—man seems to be always finding ways and means of outwitting wildlife—and took a record of geese feeding in a cornfield, where they were totally protected and felt entirely contented, and used that call in their blinds with goose decoys and the results were devastating. One set of pit blinds killed some 1,500 birds last year. One pit we know killed 92 birds in 1 day—all legally simply by moving hunters into the pit as fast as limits were filled. Those birds couldn't leave that electronic device. We had to do something about it. The device has not yet hit the Middle West in any numbers but was used extensively on the east coast, and we finally made it illegal this year, just in time, I believe.

In another year there would be so many more in the hands of the public it would have been quite a problem.

We use modern methods of detection, the airplane, for example, during the season. I think one of the reasons that it was so easy to keep the North Dakota hunters in line on that 3-day State open season was that we had a number of planes there and a hunter simply can't hide from a plane in that section. They knew if they were out hunting they would be spotted and by using air-to-ground communications our cars could quickly move in on any hunter that was hunting illegally, so there are ways and means available that do make it possible for use to stretch the agents ability to cover ground.

These are green ducklings you probably will never see. I am going into a little discussion on research, how we knew that duckling, for example, could migrate a mile or two in the downy stage cross country, maybe hitting 1 or 2 small water areas en route.

Our boys took a clutch of eggs like that and inoculated them with dye, put them back in the nest, and then they hatched out into colored ducklings. That way we were able to follow these broods all through the pothole area. It was important because there was a great difference of opinion among biologists as to just how valuable these different water areas were and we learned through this method.

Here we marked the birds with dye on the wings with different combinations, so you could spot them when they were flying.

Banding of course is still the time-honored method by which we still get most of our basic data on the migration of birds.

Here they are up north in Canada banding on a breeding ground. That area was a big, you might say, vacuum in our knowledge. We did not have enough information on young birds raised on the Canadian breeding grounds. Many of these men are Federal enforcement officers from the States that go up there. It not only makes it possible to cut down on our total cost, but it is good training for these men because they can go back and tell their people at home just what is being done up there, firsthand information.

Here they are banding through the use of the dog. We have used a number of retrievers soft-mouthed enough so that they can be used for capturing little ducklings which are very hard to catch in the grass. We had less mortality using the dog than we did capturing them in nets. Of course it takes an unusual dog. A number of dog men here in the country have volunteered the use of their dogs to us for that purpose.

Here you see the birds captured with a cannon trap. That is a net stretched out which is propelled by rockets which throw the net over birds feeding on a baited area. You notice here where they are carrying neckbands so they can be identified in flight.

In different sections we have different color combinations and their use is synchronized over the entire country.

Here is a Ross' goose, but a Ross' goose should be white. Here you see the white birds and you can spot the yellow bird flying. Through these ways and means we are learning more and more, and we need to know more and more about these birds.

Mr. GROSS. Don't the other birds ostracize them?

Mr. JANZEN. They don't seem to. Probably they would be a special target for hunters. Apparently they are not ostracized.

Water regulation on the refuges is very important. Here is a case where by planned dropping of the water level at the right time the mud flat became covered with green vegetation valuable for geese. Then, later on, after the vegetation matures, the water is permitted to reflood the flat making available to ducks the seeds produced thereby. We are learning all the time through research. We are learning how to raise more ducks and accommodate more ducks on less acres, which is obviously going to be necessary as our human population increases.

Here we cleaned out some heavy cattail vegetation with herbicides and as a result we have this millet, a valuable duck food coming back.

We have tried setting up wood duck nests in many places because as mature trees are cut down there are less places for the ducks to nest. This example shown here is almost foolproof, but it requires this bracket to keep the artificial house this far away from the tree.

A racoon can get into this device if it is close to the tree.

Here is the old type of duck nest that we had. A racoon can crawl into the smallest hole and get these eggs. They call this one a trained coon, but if a coon can do it in captivity he can do it otherwise. He can crawl in there and back out to the tree again. Now we put the nest on a bracket 2 feet from the tree and apparently it is coon-proof.

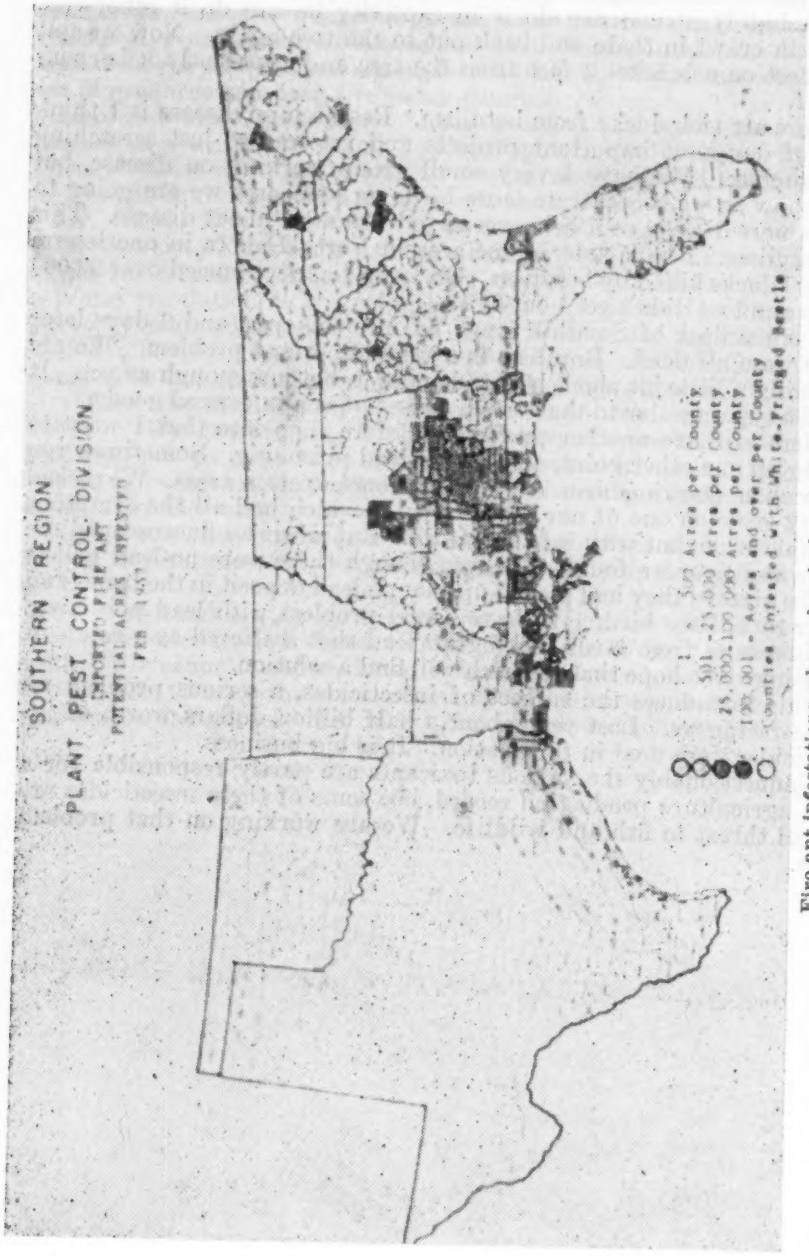
Here are sick ducks from botulism. Research on disease is I think one of our most important projects and yet we are just scratching the surface. We have a very small group working on disease, but we know as we concentrate more birds on less acres we are going to have more disease, so it behooves us to learn more about disease. This is botulism. I have seen in one area in North Dakota in one season 80,000 ducks killed by botulism. On Long Lake we buried over 20,000 1 year and we didn't get 1 out of 4.

I saw a flock of Sandhill crane fly into this area and 2 days later they were all dead. Botulism is a very important problem. We are learning a little bit about how to handle it, but not enough as yet. It is of a type, similar to that which causes poison in canned goods.

Here we have another problem. Before I go into that I want to bring up one other point, and that is lead poisoning. Sometimes you hear about starving birds in wintering concentration areas. We picked up 12 geese on one of our areas recently which had all the symptons of starvation, but with infected crops. But when we fluoroscoped the bone and liver we found that even though there were no lead pellets in the gizzard they had picked up enough lead deposit in the bones and liver to kill the bird. We have a real problem with lead poisoning. This results from birds picking up lead shot scattered as a result of hunting. We hope that research will find a solution.

This introduces the subject of insecticides, a serious problem we have facing us. Last year about a half billion dollars worth of insecticides were used in this Nation. It is big business.

Unquestionably the various toxicants are partly responsible for a fine agriculture production record, but some of these insecticides are a real threat to fish and wildlife. We are working on that problem now.


SOUTHERN REGION
PLANT PEST CONTROL DIVISION
IMPORTED FIRE ANT
POTENTIAL ACRES INFESTED
FEB 1957
1 - 500 Acres per County
501 - 25,000 Acres per County
25,000-100,000 Acres per County
100,001 - Acres and over per County
Counties Infested with White-Fringed Beetle

Fire ant infestations where chemical control proposed.

This particular slide shows the area where agricultural people are trying to clean out the fire ant through the use of Dieldrin and Heptaclor, a very potent insecticide, 15 to 20 times as effective as DDT. An excess of over two-tenths of a pound of DDT per acre can be harmful to fishes and aquatic life. More than 2 pounds is harmful to other forms of wildlife. Dieldrin is 20 times as potent and they are using 2 pounds per acre. We have had several meetings with the agricultural people in trying to work out ways and means of minimizing the damage that will occur. We think we are making some progress.

I think it important not only from the standpoint of wildlife but also from the potential threat to human health.

TABLE III.—*Toxicity to quail of various insecticides*

Insecticide	*Relative toxicity (DDT=1)*
Methoxychlor	0.1 to 0.2
Strobane	0.4 to 0.5
Chlordane	10 to 15
Heptachlor	15 to 20
Dieldrin	20
Lindane	50 to 100
Endrin	100
Aldrin	200

This shows the relative toxicity of some of the different chemicals as compared with DDT. Dieldrin is 20 times as powerful. I am going to run rapidly through these two slides to get to the third.

TABLE I.—*Effects of DDT applications upon wildlife*

	Extent of damage to—				
	Crabs, etc.	Fish	Birds	Mammals	Reptiles
0.1 pound per acre	No damage	No damage	No damage	No damage	No damage.
0.2 pound per acre	Moderately heavy losses.	Slight to moderate losses.	do	do	Do.
1 pound per acre	Heavy losses	Heavy losses	Slight to moderate losses.	do	Do.
2 pounds per acre	do	do	do	do	Do.
4.4 pounds per acre	do	do	Heavy losses.	do	Heavy losses.

This slide shows pounds per acre needed to harm different forms of fish and other wildlife. As you increase your dosage, you have more damage done to more species until you get to the mammal stage. Mammals appear to withstand a heavier dosage than most other forms.

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Table II. EFFECTS OF DDT UPON REPRODUCTION OF QUAIL

Amount in Diet	Chicks per Hen	
	(a) Hatched	
None	[redacted]	(40.3)
1 oz/625 lb.	[redacted]	(27.3)
	(b) Survived 12 weeks when fed insecticide-free diet	
None	[redacted]	(32.2)
1 oz/625 lb.	[redacted]	(5.0)

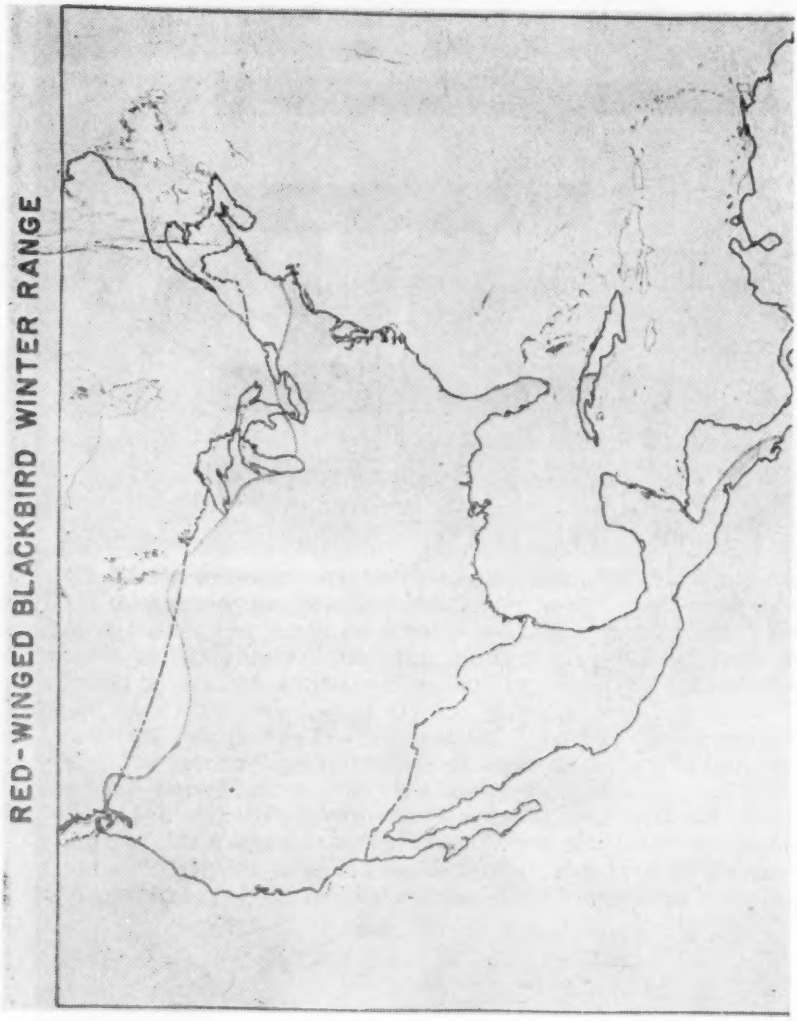
Effect of insecticides on wildlife reproduction.

This slide shows something that is bothering us. Even though the DDT dosage may not be sufficiently heavy to kill an adult bird, we find that exposure can result in greatly reduced reproduction. We find, what is more significant, that the young birds produced from parents affected by DDT are unable to reproduce if they in turn are also exposed to a sublethal diet of DDT. What the result may be I don't know, but I don't like the implication. There certainly needs to be a great deal more research on some of these pesticides to find out what the long-term effects will be. We are quite concerned.

This is blackbird control—the species of bird with which we have quite a problem on sweet corn. Some of you may have had complaints from some of your constituents because of this type of damage.

Agriculture is good for blackbirds. This shows their breeding area.

Redwing blackbird breeding range.



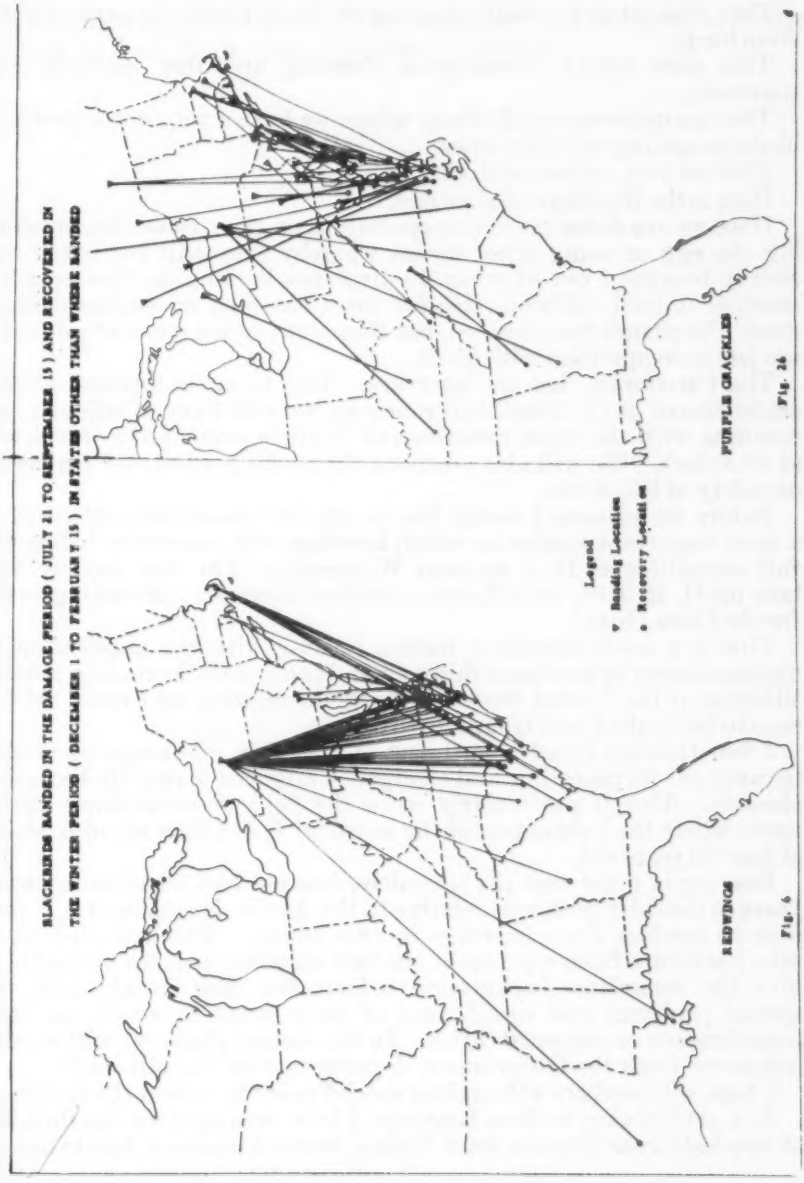
Redwing blackbird wintering range.

Here is their wintering area. It covers the entire United States.

Here is the concentration on their wintering grounds but these are not the ones that are doing most of the damage. Usually the damage is done in the spring when they are on their breeding areas.

This is some of your damage to sweet corn and sometimes damage extends to one-third of the crop in a local area. It is very important. Here is sweet corn harvested. This is field corn.

This is field corn areas, showing the size of this.


BLACKBIRDS BANDED IN THE DAMAGE PERIOD (JULY 21 TO SEPTEMBER 15) AND RECOVERED IN THE WINTER PERIOD (DECEMBER 1 TO FEBRUARY 15) IN STATES OTHER THAN WHERE BANDED
Legend
Banding Location
Recovery Location
REDWINGS
Fig. 5
PURPLE GRACKLES
Fig. 24

Blackbird migration from depredation locality to winter concentration area.

We have been working on research methods, mainly repellents, because we have found that these birds, while nesting in one location and doing the damage there, don't go to the same winter concentration areas. Biologists estimate that we might have to kill 60 percent of the blackbirds before we would begin to show any general relief in damage areas, which is almost, I think, something that the public wouldn't stand for. That would be just wholesale slaughter, so we are trying to work out the problems right where the damage is being done.

This is an acetylene device, used to scare birds.

This slide shows actual covering of fruit plants to protect them from birds.

This slide shows Washington cleaning up after starlings and sparrows.

This is a quick shot of Midway where we have a very acute problem, birds competing with airplanes.

This is a very serious problem.

Here is the blackfooted albatross.

Here we are doing poisoning operations on their rookeries, puncturing the egg or using other means whereby they will not hatch out, simply because 1 out of every 15 airplanes landing on that area has resulted in bird collision. So far there has been no serious damage done. No planes have crashed, but they want to use jets and you can't use jets in competition with birds.

The CHAIRMAN. Let me interrupt. Due to an unforeseen Democratic caucus at 11 o'clock this morning, we will have to adjourn and continue with the sport fisheries and wildlife presentation tomorrow at 10 o'clock. We will also postpone the meeting scheduled tomorrow on safety of life at sea.

Before we adjourn I would like to call the committee's attention to a most important matter on which hearings will commence before the full committee at 10 a. m. next Wednesday. On that day we will take up H. R. 9196, to authorize a nuclear-powered icebreaking vessel for the Coast Guard.

This is a most important matter because with the application of nuclear energy to merchant shipping and the greatly increasing responsibilities of the United States in the polar regions, we cannot act too soon to bring the Coast Guard up to date.

I fear that the Coast Guard fleet of vessels in all categories needed to carry out its peacetime and emergency missions is rapidly becoming obsolete. This is particularly so in the field of icebreaking equipment, where the icebreakers of the so-called *Wind* class are of a design at least 20 years old.

Bearing in mind that the committee has not had occasion in recent years to consider problems relative to the Arctic and Antarctic, I propose to conduct these hearings in two phases. The first will be to take testimony from a group of the best qualified persons available to give the committee background information and insight into the special problems and significance of those areas in which we have commitments or responsibilities. In the second phase we will receive testimony from the Government departments on the bill itself.

I hope all members will make a special point to attend the hearings.

As a preliminary to these hearings, I have arranged for the showing of two half-hour films on joint United States-Canadian Arctic opera-

tions in the past several years. One film will be presented by Vice Adm. John M. Will, commander, Military Sea Transportation Service. The other, Commodore O. C. S. Robertson, the Canadian Navy member of the United States-Canadian joint staff, has graciously agreed to present.

The showing will be held in the committee room on Thursday of this week at 4 p. m.

With this statement the committee will now stand adjourned until tomorrow morning at 10 o'clock, and this witness will resume his testimony.

(Whereupon, at 10:50 a. m. the committee was recessed, to reconvene at 10 a. m. Wednesday, January 15, 1958.)

REVIEW OF FISH AND WILDLIFE SERVICE

WEDNESDAY, JANUARY 15, 1958

HOUSE OF REPRESENTATIVES,
COMMITTEE ON MERCHANT MARINE AND FISHERIES,
Washington, D. C.

The committee met at 10 a. m., pursuant to recess, in room 219, Old House Office Building, Hon. Herbert C. Bonner (chairman) presiding.

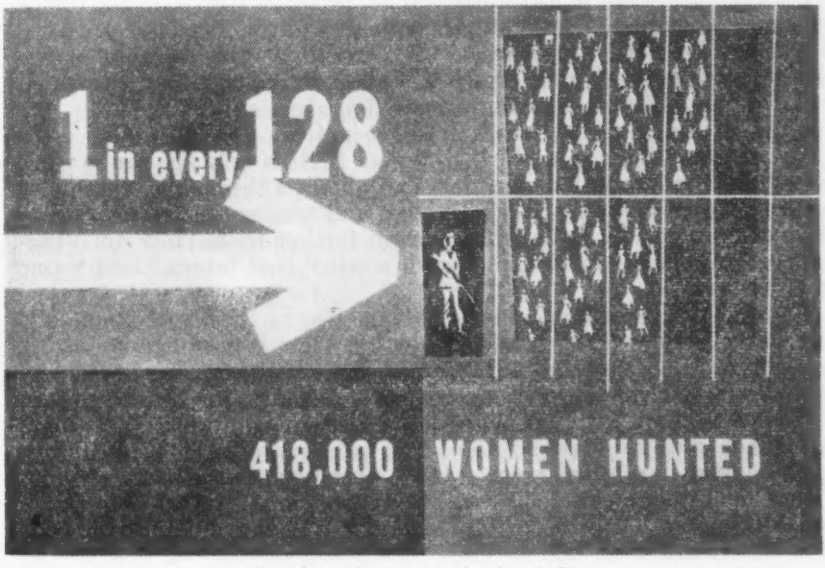
The CHAIRMAN. The hearing will come to order.

We will continue with Mr. Janzen of the Fish and Wildlife Service.

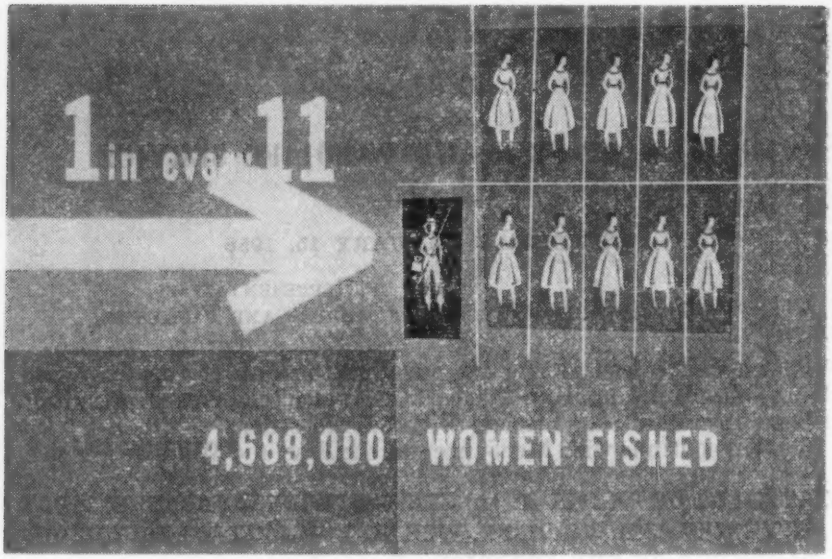
STATEMENT OF DANIEL H. JANZEN, DIRECTOR, BUREAU OF SPORT FISHERIES AND WILDLIFE, FISH AND WILDLIFE SERVICE, DEPARTMENT OF THE INTERIOR—Resumed

Mr. JANZEN. Mr. Chairman, one question asked at our hearing yesterday was what was the participation of women in the sport of hunting and fishing. I have a couple of slides that will answer that question.

Just to refresh your memory, 1 in every 5 men hunted; and this indicates 1 in every 128 women hunted. In other words, a total of 418,000 women hunted, according to that economic survey.



Number of women who hunted.



Number of women who fished.

One man out of every four fished. Almost 13 million men fished. The figure for women is 1 out of every 11, with a total of a little over 4½ million women that fished. I believe that answers that question.

The other question asked which I was not able to answer was what kind of waterfowl production could we expect from a tract of land like you see there? We were talking I think particularly about this area (slide) at the time.

I mentioned that in our program to preserve wetlands we might purchase a complete area like this rather than try to just acquire the rights to the small water areas. We would do this because of the nice complex of small and large water areas found on this tract, which we have found is important in waterfowl production.

The CHAIRMAN. What area is that?

Mr. JANZEN. This is in North Dakota. This is very similar to what we would commonly find in an area of about, I think, 150,000 square miles in North Dakota, South Dakota, and western Minnesota. The production gets a little better as you go farther west. For some reason the birds prefer that open prairie section, that intermittent water area farther west.

The production in some of the best habitat in the United States is as good as the best habitat in Canada, but there is so much more of it in Canada. That is the essential reason you have so much more waterfowl production in Canada than the prairie area of the United States.

We have found from our surveys that best prime waterfowl habitat in Canada will run around 150 birds per square mile. It will run much heavier in selected areas. If we purchase areas like this, which is very definitely a selected area, I think we can anticipate a production of around 300 birds per square mile. That would mean about 75 birds on this area, but we must consider again that we are talking about the long-term pull.

I think the next question would be what would that cost per bird. The question was asked what would that land cost us. I think I said $25 to $50 an acre. The estimate of my staff was $35 an acre. We would not know for sure until we got into this program, because until you actually make some offers you won't know for sure what you can do. However, on that basis, over a 100-year period we estimate that if the production was 75 birds on a quarter section, it would cost us about 75 cents per bird. That does not take into consideration that these lands would be used for other purposes, could be used for agriculture, and we could, for instance, on a lease basis bring money back into the Federal Treasury to recompense for that purpose, so it can't all be charged up to waterfowl. We are thinking in terms that if we go into a program that would acquire some of these areas we would go into it slowly on a demonstration basis. We think we can demonstrate agricultural methods there that will help save wetlands. We know that there are some types of grasses that can be grown on the bottom of these areas that will produce fine food for livestock. There are other uses for these wetlands. Possibly in some areas we can convert the use more to a grassland utilization.

An agricultural authority at the University of Minnesota in agriculture told me not so long ago that he felt that the Minnesota grasslands properly managed, properly fertilized, could raise as much beef as their row crop system could, and they are encouraging at the agricultural school at the university a grassland economy, and of course these wetlands fit in perfectly with the grazing economy because you have to have water all through your grazing range to scatter your grazing so that the livestock do not concentrate in one area.

There are possibilities and if we could have some of these areas to work with we think we can increase production.

Mr. RAY. I asked the question you were answering, I think. I was working toward the picture of the economics of the situation. You say the cost is 75 cents per bird. That is spreading the cost over a 1-year period?

Mr. JANZEN. No, that is spreading the cost over the long pull, we will say a hundred years, but it could be forever, because that capital investment does not deteriorate. In other words, we expect a hundred years from now that it will be as productive for waterfowl as it is now. It is not quite like a factory which a hundred years from now would have to be written off. I am not considering this mathematically sound. A mathematician would probably come up with a different answer.

Mr. ALLEN. What is a bird worth? You get, say, a hundred birds raised and maybe 10 are hunted. What is the expenditure on a hunted bird, or what is the bird worth in that sense to the industry?

Mr. JANZEN. We did a little checking on that with the staff because I anticipated that question. The best figures that we can come up with is that the hunter is paying about $10 a bird for bird in the bag. That is about what it is costing the hunter. That is what he is willing to pay and I presume the bird is worth that if the public is willing to pay for it.

Mr. ALLEN. If you raise a hundred birds have you any statement as to how many the hunters get?

Mr. JANZEN. That is a good question, too. I have been advised that the kill has been running about 35 percent.

When I talked about this production I was talking about raising the birds to the adult stage, the flying stage to the point where they can be hunted, and on that basis of the adult birds that are raised about 35 percent end up in the bag.

Mr. ALLEN. On a hundred birds it would cost you $75 wouldn't it, at 75 cents apiece, and to the hunter that hundred birds would be worth $350?

Mr. JANZEN. That is about right, I think. Yes.

Mr. ALLEN. Thank you.

The CHAIRMAN. Did you finish?

Mr. RAY. No, but go ahead.

The CHAIRMAN. No, you continue.

Mr. RAY. You just used one element of the Government's cost in these figures we have just used? The land investment?

Mr. JANZEN. That is right.

Mr. RAY. Can you complete the picture?

Mr. JANZEN. We are anticipating that these will not require any comparable overhead that we have on our national wildlife refuges where a great deal of our habitat is created by dams and dikes which have to be maintained.

There will be some administrative expense, for example, to take care of the agricultural management, but the agricultural management of course will also bring in a return to the Federal Government.

Mr. RAY. Do you have an estimate of the overall cost to the Government?

Mr. JANZEN. I don't have an estimate. You mean taking into consideration all program and administrative costs.

Mr. RAY. Yes.

Mr. JANZEN. No, I do not have that figure here. We could make an estimate if you wish to have that inserted in the record.

Mr. RAY. I wouldn't like to have any large amount of work done on it, but if the figures are readily available I think it would be well to have it in the record.

Mr. JANZEN. Yes, I agree with you.

(The following insertion was furnished.)

FEDERAL EXPENDITURES PER DUCK IN THE HUNTER'S BAG

It is very difficult to estimate what proportion of Federal expenditures for wildlife management can be properly charged to ducks. A reliable estimate would entail a careful analysis of the day-to-day activities of all Service employees scattered throughout the United States working on enforcement and management, land acquisition, river-basin studies, wildlife refuges, wildlife research, and administration. Many of these employees have responsibilities in the fields of both fish and wildlife management. Approximately 487 species of migratory birds are involved in migratory-bird management alone, of which 32 species fall into the game-duck category providing sport for the hunter. Using available data without a detailed field analysis, it has been determined that approximately $6,221,951 of the total funds expended for the Federal wildlife management program in fiscal year 1957 can be properly charged to ducks. Using the 1956–57 hunting season bag of 12 million ducks, it is estimated that in 1957 there was expended approximately 52 cents for each duck in the hunter's bag. It should be emphasized that this figure cannot be used as an average figure. The expenditure per duck may vary widely from year to year, depending upon the land acquisition and construction programs in force. Expenditures for these programs have fluctuated a great deal in the past.

The CHAIRMAN. You say there is 35 percent depletion of the birds you raise. Does that imply that the other 65 percent is increased in the total amount of birds we have?

Mr. JANZEN. No, sir. There is a gradual loss of birds all through the year through various natural causes. It could even be old age if they had an opportunity to live that long, but because of disease, predation, and various reasons, there is a gradual decrease in the number from the time the birds leave the Canadian Provinces and the prairie potholes until they come back again about 9 months later, or 8 months later.

The CHAIRMAN. Are the birds on an increase, or decrease?

Mr. JANZEN. They have just about been holding their own over the last few years. We have had some reports that are bothering us this year. The hunting reports have not been good in some sections of the country. In some sections, however, in the Middle West especially, there have been some phenomenal reports. Until we have a return on our winter inventory we wouldn't want to hazard a guess as to what has happened, but after our winter inventory, that knowledge, fortified with our initial breeding grounds surveys, will give us a pretty good idea again whether our index is going up or going down. I wouldn't want to hazard a guess.

The CHAIRMAN. Over the last 2 or 3 years has there been any noticeable decrease in the birds frequenting their former habitats, or have they changed their habitats?

Mr. JANZEN. I would say there has not been a noticeable decrease overall. In some sections there may be, yes. The migratory birds do shift. They quickly find where there is food and also they find where there is protection, and some of the shifts we have not yet been able to explain completely, but they do shift and it is sometimes very difficult to say why from one year to the next.

The CHAIRMAN. Go ahead, sir.

Mr. JANZEN. I hastily ran through a few slides yesterday and I don't think you got the point probably of what I was trying to put across on this Midway Island conflict between birds and airplanes. I think that it serves to illustrate how in our present civilization there are some occasions when we begin to wonder how we will ever be able to manage some species in the face of civilization's inroads, and the airplane is one of our problems. On Midway Island the Defense Department has an airport, but up to now they have only been able to use propeller driven planes because jets may flame out if they suck a bird into the jet engine. They have so many strikes here that we have had some men working down there specially now for 2 years trying to find a solution for this problem without completely wiping out the birds. The birds are called the gooney bird locally. They are the albatross. That is the bird there on the screen, a pretty good sized bird.

I have some figures here that rather startled me the first time the report came to me. During a 2-month period, 60 days, out of 388 landings, there were 29 strikes. One out of every 13 planes struck a bird. Fortunately there were no crashes. There was damage done to a number of planes. Over a period of time we estimate that 99 planes struck 114 albatrosses. It is a continual hazard to the planes. It is of grave concern to the Navy and we must find a solution.

I will run through those. These are the birds on their rookery.

Here is a bird on a nest. This happens to be the Laysan albatross. The other was the black-footed.

This is a black-footed again and their mating antics. Here we tried inoculating the egg with a chemical so the egg would not hatch. However, apparently a reduction in numbers isn't sufficient. The concentration has to be moved out of there and yet this is where they have always been. The local people don't like wholesale slaughter. There isn't very much recreation and they rather seem to enjoy the birds—especially the enlisted personnel.

We have tried experimenting with leveling the sand dunes so as to change the air current crossing the runway and there seems to be real promise there. This might stop the birds soaring over the runways. It is a rather expensive proposition, but still the total expense wouldn't be as much as the crash of one transport plane, and the Navy is cooperating very closely on this thing. They are very much concerned and they are trying to find a solution without wiping them out.

We must find a solution for this, because once they start using jets, and these jets flame out there will be crashes. There is not much choice.

The birds are marked to find out where they will move, because if we wipe them out we must know if they will immediately be replaced by birds from other areas. We are marking birds all over in that section.

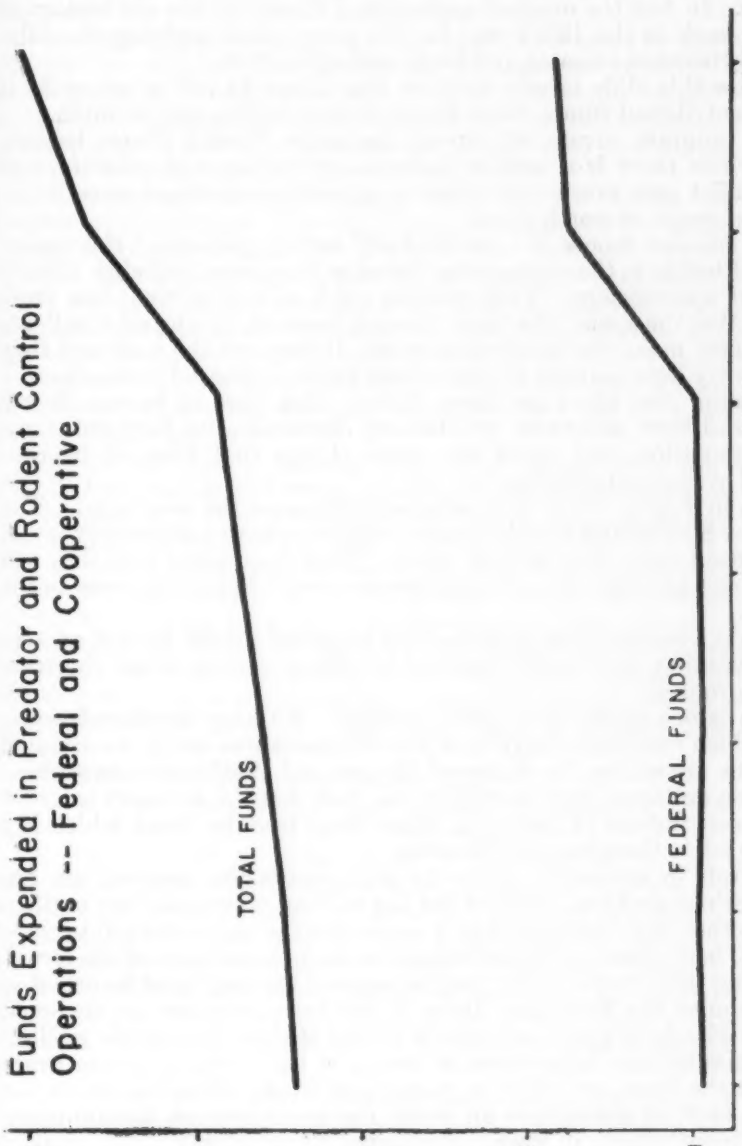
Another slide shows just a sample of some of the marking of the birds.

Mr. GROSS. How many people do you have down there?

Mr. JANZEN. There has been one person and I think he was accompanied by one other person for a short period of time.

Mr. GROSS. Is the Navy reimbursing you for this?

Mr. JANZEN. Yes, the Navy is taking care of this. They are very much concerned.



Relationship between Federal and cooperative expenditures for predator and rodent control operations.

This graph shows you the relationship between our Federal contribution and the cooperative contribution on our predatory animal and rodent control program. This is one of the old programs in our service. In fact the original authority, I think, for the old biological survey back in the 1800's was for the purpose of studying the relationship between animals, and birds, and agriculture.

I show this slide merely to show that about $1 out of every $4 is from contributed funds, State livestock associations and so forth.

The program covers, of course, the entire United States because everywhere there is a conflict between agriculture and wildlife, and the conflict gets worse and worse as agriculture becomes more intensive and crops are worth more.

The meadow mouse is a particularly serious problem. For example, in Florida in the watermelon industry they have probably 100,000 acres of watermelons. They have as much as a 20 percent loss from mice eating the seeds. We have through research developed repellents which now make the meadow mice sick if they eat the seed and they apparently have learned to leave those types of treated seeds alone.

In doing that there are many factors that have to be considered. We found some otherwise satisfactory chemicals, but they cut down on germination, and there are many things that have to be considered in that sort of thing.

Mice in forests are a very serious problem on the west coast. The Forestry Service and the big lumber industries have particularly urged us to spend more time on that phase. They have asked how they can seed direct and save the great manpower cost of planting trees in the forests.

Here is a burned-over area that can be seeded maybe for $12 an acre by air seeding, but it will cost $40 or $50 an acre to plant the trees on the ground.

Here is one of the helicopters seeding. We have developed repellents which now apparently have proved themselves and it is estimated that they are saving the States of Oregon and Washington now about a million dollars a year, merely by the fact that the foresters can now seed direct instead of having to plant those trees by hand, which is a tedious job in these inaccessible areas.

The rats in connection with the grain sanitation program are another serious problem. One of the big milling companies just notified us the other day that they had 5 carloads of cereals returned because rats had been found in the cereals and contaminated some of the cereal.

During this program of trying to improve the quality of flour and so forth, under the Food and Drug it has been necessary to condemn many carloads of grain coming out of the Middle West to the milling companies because somewhere en route, in the fields, or in the grain bins on the farm, or while in storage, or in the elevators, or on the freight cars, or somewhere en route, the grain became contaminated to the point where it wasn't considered of sufficiently high quality for milling purposes. That is a very serious problem and we have been called upon because of our long experience in rodent control in this field to cooperate, which we are doing.

Our predator program in the West is, we might say, on a maintenance basis. Many years ago we were able to reduce the predators to the point where in many sections they were able to produce livestock, where before it was almost impossible. By keeping control of this

program and working closely with our cooperators, we are able to use selective control means which give the greatest protection to other forms of wildlife which might be adversely affected by the methods that ranchers ordinarily would like to use.

The need for selective control can well be illustrated by my personal experiences as a boy when I was raised in Montana and my dad and mother got in an argument as to whether I was old enough to carry a saltcellar of strychnine in my pocket in order that whenever I found a dead cow or horse I could dose the critter with strychnine, and of course anything that ate that critter died.

I can remember that to this day. That was the way we carried out control in those days. We didn't care about anything else as long as we got rid of the coyote.

This slide shows the coyote. It is primarily controlled through what we called our 1080 program and this is a program that resulted through many years of research. We finally discovered a chemical, a very selective toxic chemical, particularly effective on coyotes whereby during certain periods of the year we can greatly reduce the population to the point where we can selectively control remaining offending individuals as necessary.

We can take care of calls by airplane hunting. When the rancher says "I lost a number of sheep," usually it is to a pair of coyotes. Since the coyotes have been knocked down enough in total population we can usually send out a plane to get that particular pair of coyotes. We do want to keep them down in numbers generally so that we can economically take care of the individual species. The livestock industry in the West must have that kind of protection if they are going to continue in business or they will take care of it through other means. We are very much concerned, should they start to use some of the lethal methods that are available to them, that they might do a wholesale job on other forms of wildlife and it might be hazardous to man also.

That, Mr. Chairman, concludes my illustrated talk.

I have here 3 bills that I was requested to report on, 3 bills in the last several years. Shall I at this time proceed?

On July 3, 1956, Congress passed Public Law 654, which authorized and directed the Secretary of the Interior to requisition Government-owned grain from the Commodity Credit Corporation for use in luring migratory waterfowl away from farmers' crops so as to prevent waterfowl damage to such crops. During the fiscal year 1957, the first year that this was in operation, the Bureau of Sport Fisheries and Wildlife found that it was necessary to requisition two carloads of grain, 110 tons in all, at a cost of $735 for packaging and rail transportation.

The grain was distributed in several areas in the State of North Carolina and effectively reduced duck and goose damage to several types of crops.

Another carload of grain has been requisitioned for North Carolina this year. That has been the extent to which it has been necessary for us to requisition this grain during this past year.

Another act had to do with limiting the importation of wild-bird feathers mostly for fly-tying use. I think it was an industry request.

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The act of July 7, 1956, which amended paragraph 1518 of the Tariff Act of 1930, limited the number in kind of wild-bird feathers that can be imported annually and authorized by the Secretary of the Interior to allocate annual quotas to qualified applicants.

Pursuant to the provisions of the act, the Secretary of the Interior on July 24, 1953, adopted regulations providing for the equitable allocation annually of 5,000 skins of gray jungle fowl, 1,000 skins of mandarin duck, 45,000 skins in the aggregate, of the following species of pheasants: Lady Amherst, golden, silver, Reeves, blue-eared, and brown-eared.

We think the regulations have proven effective and have been accepted generally by those interested in importing wild-bird feathers. Although applications for import quotas each year have oversubscribed the total annual allowable quotas, only a small portion of those total annual quotas have been entered because of foreign control restrictions on imports from countries behind the Iron Curtain. In the past these countries have been the principal source of wild-bird feathers.

In other words, this act has not created any particular problem. It has worked out satisfactorily.

The other act has to do with the establishment of the National Key Deer Refuge. As you know, back on February 1, 1954 this refuge was established with what we call dollar-a-year leases from private owners and we established a refuge which covered about 6 or 7 thousand acres.

On August 22, 1957, the National Key Deer Refuge Act was passed authorizing the purchase of 1,000 acres within a group of keys.

Funds are not available to acquire the lands for this program. Duck stamp funds cannot be used, and I might add that Florida does not at the present time have enabling legislation on the books that would permit us to acquire the lands. We are about where we were except that we did receive a grant for some land for the headquarters and we are proceeding as rapidly as we can, but at the present time there have been no lands purchased.

Mr. YOUNG. Might I ask the witness a question?

The CHAIRMAN. Yes.

Mr. YOUNG. Mr. Witness, you stated that there had been a policy of leasing for a dollar a year from landowners on key deer.

Mr. JANZEN. That is correct.

Mr. YOUNG. Has that policy been a success?

Mr. JANZEN. Yes, except that that lease of course can be broken by mutual agreement by either party.

Mr. YOUNG. However, as long as the lease is in effect it has been successful?

Mr. JANZEN. Oh, yes. Our problem is because of real-estate development down there. We have to have something a little more solid to tie to.

Mr. YOUNG. You had about 6,000 acres?

Mr. JANZEN. Yes. That has been very satisfactory and will be continued.

Mr. ALLEN. What is the present record on the key deer herd? Is it going up, or going down?

Mr. JANZEN. There has been some increase since the refuge was established and I think now we estimate that there are around 150 key

deer. I talked to the regional director from that section just yesterday and I said "Why do you feel that there has been this increase?"

He said "Because of the special attention given to the key deer resulting from the establishment of this refuge there, people are more conscious of the animals and they are giving them better protection, trying to avoid hitting them on the highways and so forth."

Mr. ALLEN. If my memory serves me correctly, that would be an increase of 50 to 100 percent in about 2 years.

Mr. JANZEN. It is possible. Deer multiply fast if given protection and proper environment. Very rapidly.

Mr. ALLEN. Thank you.

Mr. JANZEN. Of course that is an estimate, as the original figure that you probably had was also an estimate.

Mr. ALLEN. Thank you.

The CHAIRMAN. That concludes your general statement?

Mr. JANZEN. Yes, that concludes my general statement and, as you know, the sport fisheries portion of my testimony will be given by Mr. Gottschalk, Chief of our Sport Fisheries Division.

The CHAIRMAN. Mr. Zincke, counsel of the committee, would like to ask you a question.

Mr. BERNARD J. ZINCKE (committee counsel). Mr. Jansen, you stated that the cost of raising birds on this particular example of wetlands that you showed would run about 75 cents a bird over a hundred-year period. What items did you include in that cost figure?

Mr. JANZEN. I only included the acquisition cost, the cost of buying the land.

Mr. ZINCKE. The interest would run another 75 cents over that period?

Mr. JANZEN. That is correct. We have not considered interest. I also have not deducted what the land would bring in from agricultural products and so forth. It was just a figure and needs a great deal of work to come up with a figure that we could use.

Mr. ZINCKE. In any event, the figure would be considerably higher than your 75 cents, wouldn't it?

Mr. JANZEN. It would be, providing that all of the cost of the land were to be charged to waterfowl, which I don't think we could. I might mention also that the land would be very valuable for other forms of wildlife, including other migratory birds.

Mr. ZINCKE. Has any attempt ever been made to figure the cost per bird on all your refuges?

Mr. JANZEN. I don't have such a figure.

Mr. ZINCKE. In other words, how does the 75-cent figure compare with your total overall cost?

Mr. JANZEN. As far as production is concerned this would be much more reasonable, but of course the key refuges also furnish a great deal of food during their migration and on their wintering grounds, but I can say without doing any checking that the cost of producing birds on refuges would be much more, because most of our refuges are not production areas.

Mr. ZINCKE. What I had in mind was this: How much does a bird stand the Government, a bird killed by a hunter? Have you ever had any figures on that?

Mr. JANZEN. No, sir; I have never worked up any figures on that. It is very difficult to estimate what proportion of Federal expendi-

tures for wildlife management can be properly charged to ducks. A reliable estimate would entail a careful analysis of the day-to-day activities of all Service employees scattered throughout the United States working on enforcement and management, land acquisition, river basin studies, wildlife refuges, wildlife research, and administration. Many of these employees have responsibilities in the fields of both fish and wildlife management. Approximately 487 species of migratory birds are involved in migratory bird management alone, of which 32 species fall into the game-duck category providing sport for the hunter. Using available data without a detailed field analysis. it has been determined that approximately $6,221,951 of the total funds expended for the Federal wildlife management program in fiscal year 1957 can be properly charged to ducks. Using the 1956–57 hunting season bag of 12 million ducks it is estimated that in 1957 there was expended approximately 52 cents for each duck in the hunter's bag. It should be emphasized that this figure cannot be used as an average figure. The expenditure per duck may vary widely from year to year, depending upon the land acquisition and construction programs in force. Expenditures for these programs have fluctuated a great deal in the past.

Mr. ZINCKE. To go to another topic entirely, some time ago the Service was kind enough to send me a chart of the people employed in the various divisions in the regional offices and I spoke to you about it.

In regard to the Division of Fisheries, I note in region I that you have in the Division on the first square there on your tabulation under "Game fish and hatcheries," six people. You have 18 field stations and 130 employees in the field.

Do you have those figures, sir?

Mr. JANZEN. Yes; I have them right here.

Mr. ZINCKE. That is region I. In region II you have 8 people and 1 vacancy in your office with 16 stations, 2 less than region I, and 46 people in the field.

In other words, you have 9 positions in the office to 46 in the field in region II and you have 6 people in the office to 130 people in the field in region I.

In the first place, are those figures comparable?

Mr. JANZEN. Yes; the figures are comparable.

Mr. ZINCKE. What accounts for the wide variation?

Mr. JANZEN. I happen to have the information right here because we analyzed these charts very carefully. We were a little concerned. I had the same question I think on this one and several others, but on this one the answer is very obvious.

On the west coast our production goes mostly into salmon, a large number, and the distribution cost and the overhead on distribution is relatively small.

For example, we had only 570 applications to fill on the west coast in region I. In region II in 1956 we had 18,000 applications, and this year they tell me it has risen to 36,000 applications, which requires a tremendous amount of coordination at the regional level to see to it that the applications are filled from the right hatcheries, the right species, and the closest or the most efficient method of distribution is used, so there are some extra people in the regional office working on this tremendous load of applications.

Mr. GROSS. Applications for fish?

Mr. JANZEN. For fish. I have the exact figures, here.

In region II—the figures I gave you were filed applications—they actually had 26,990 applications in 1956. They were able to fill out of that a total of 17,537.

In 1957 so far this year they have had 60,017 applications, of which they are going to fill about 43,000. That is a tremendous job. Much of this is this farm pond program, this big farm pond program that has taken the country by storm. It is a fine program as far as we are concerned. It is good for wildlife. However, we furnish the fish to the Department of Agriculture for the initial stocking of those ponds.

Mr. ALLEN. What States are those?

Mr. ZINCKE. Region II, Wyoming, Utah, Texas, Kansas, Arizona, New Mexico, Colorado, and Oklahoma.

The CHAIRMAN. Is that the region that has so many applications?

Mr. JANZEN. Region IV in 1956 had 36,904 applications.

Mr. ZINCKE. And they have 9 people in the office against 101 in the field.

Mr. YOUNG. Would counsel yield to me?

Mr. ZINCKE. Yes, sir.

Mr. YOUNG. Do I understand your Department furnishes the original stock of all these farm ponds?

Mr. JANZEN. That is correct, sir, where the farm ponds bear promise of producing fish. They have to qualify.

Mr. YOUNG. At what cost to the owner of the farm?

Mr. JANZEN. At no cost to the farmer. This is in connection with the Federal program, the Department of Agriculture program, for building farm ponds.

Mr. YOUNG. You know the Federal Government puts up part of the cost of stocking the farm and you don't make any charge for it?

Mr. JANZEN. Yes, sir.

Mr. YOUNG. That is sport fishing, isn't it?

Mr. JANZEN. That is right.

Mr. ZINCKE. We come to region IV with 9 people in the office and 101 in the field.

Mr. JANZEN. Yes. They have a farm-pond load there comparable to region II.

Mr. ZINCKE. But in region II 9 people took care of 46 people in the field. In other words, it takes over twice as many people to produce the fish in region IV as it does in region II.

Mr. JANZEN. No. Again it has to do with the tremendous amount of work in handling these applications.

Mr. ZINCKE. How many applications in region II?

Take comparable years.

Mr. JANZEN. I have to get comparable years. In region II they filled 18,617 in 1956. In region IV they filled 36,943 in 1956. I do not have the figures on the number of unfilled applications in region IV.

Mr. ZINCKE. Apparently, then, the number of people in the office has no relation to the number of applications filled, because it took 9 people in the office in region II to fill 18,000 applications and only 9 people in region IV to fill twice that number.

Mr. JANZEN. Let me see if I have this question correct. Your figures show that the number of people in the regional office in region II are the same?

Mr. ZINCKE. My figures, as you gave them to me, as of June 30, 1957—I assume there was no radical difference in 1956, was there?

Mr. JANZEN. No, sir.

Mr. ZINCKE. Show 8 people and 1 vacancy in the office.

Mr. JANZEN. In region II.

Mr. ZINCKE. Yes, as against 46 in the field and 16 field stations. In region IV, I have 9 people in the office, 24 field stations, and 101 in the field. The explanation you gave me as between region I with 6 in the office and 130 in the field was that there was a relatively easy job in filling applications because they were for salmon, and that region II required more people in the office in relation to the people in the field because they had more applications to process. I ask you what the situation is, comparing region II and region IV.

Mr. JANZEN. Yes. The figures that I gave you in 1956 are filled applications; region II, 18,607, and region IV, 36,934.

Now, I notice by the detailed information I have that in 1957 the applications in region II are much more comparable to region IV; in other words, 26,990 filled out of 60,000 applications. As to those 60,000 applications, I think region IV is much better able to fill their applications, probably, than region II. That is right; yes. I think we will find that the workload on applications in region II was just about equivalent to that in region IV during 1957.

Mr. ZINCKE. Now, go back to region I. How many applications did you have?

Mr. JANZEN. They had 570.

Mr. ZINCKE. Let's put it this way, then: In region I, it took 6 people in the office and 130 in the field, or 136 people, to handle 570 applications. In region II, it took 9 people in the office and 46 in the field, which would be 55, to handle 18,000; and in region IV it took 9 people in the office and 101 in the field, or 110, to handle 36,000 applications. Are those figures comparable?

Mr. JANZEN. These men do not only work on applications. Here is our usual supervisory structure in the regional office: A supervisor has two assistants. One is an expert on production at the hatcheries. He works with the hatchery superintendents, trying to work out the latest hatchery techniques. The other man is in charge of physical maintenance, you might say, operations. That is his specialty. We try to keep each of these hatcheries as efficient as possible and try to use all the newest methods and so forth.

Then, in addition, they will have 1 or 2 people working on applications, and this will be a clerical force of a couple of people. That will make 7 or 8.

Mr. ZINCKE. But there are only 1 or 2 people working on applications in each region?

Mr. JANZEN. During different periods, it might be more. Part of our clerical force might be working on applications. As to applications, I would say that the workload is pretty much the same as between the different regions, but in the regional office in region I the reason that they haven't as many people is because of the fact that they don't have to handle that tremendous amount of paper

which has to be handled at the regional-office level in order that you get the most efficient distribution.

Mr. ZINCKE. Mr. Leffler indicated to me that, in general, the ratio of supervisors to workers would run from 1 to 8 to approximately 1 to 12 or 14. Is that your observation with respect to the ratio of supervisors to workers in this particular field?

Mr. JANZEN. I would say this: That figure may be about right, but they aren't all supervisors again; this group of 9 that you are talking about, or 8. Half of them are clerks.

Mr. ZINCKE. All right; what about the other half, 4½?

Mr. JANZEN. Oh, let me make one other point here.

In this group are included a couple of biologists. I would have to check to see how many, but I think they will average at least two biologists who inspect the sites which are to be stocked. Generally speaking, in our big program of cooperation with the States, we have the States do as much of that inspection work with their State biologists as possible, but there is a certain amount of applications that we have to investigate ourselves, and some of these men also investigate and study other Federal installations, military installations, Forest Service lands, and make recommendations to the supervisor as to the practicability and efficiency and whether it is desirable that these fish be planted in these waters.

Mr. ZINCKE. In other words, in region II you have two-thirds as many field stations and about 45 percent as many employees in the field as you have in region IV, and you have the same number of people in each office. Do you feel that that is reconcilable?

Mr. JANZEN. We would have the same supervisor and two assistants.

Mr. ZINCKE. Regardless of how many installations you have, if you have one or more?

Mr. JANZEN. We don't have one.

Mr. ZINCKE. You have 16?

Mr. JANZEN. Sixteen is the lowest. Yes; we would have a man each, because they are in a specialty field. The man, the production expert, whether he has 16 hatcheries or 25 hatcheries, should be on the job; yes.

Mr. ZINCKE. Then there is no relation between the number of people in the field in any region and the number of people in the office in that region?

Mr. JANZEN. No, sir. You would have to analyze the workload.

Mr. ZINCKE. I have been trying to do that, and you have been giving it to me on the basis of applications, and then you tell me that that isn't the point. Is the workload the same as between 16 installations and 24? Is the workload the same in supervising 46 people as it is in supervising 101?

Mr. JANZEN. It would also depend upon the character of the hatchery. If you have big hatcheries, you have a much bigger output. It might take a little more work; yes. We would have to analyze each. If you would like to have a complete analysis made of this situation, we would be glad to furnish it.

Mr. ZINCKE. I would appreciate it, sir, if you don't mind.

Mr. JANZEN. Yes, sir; we will be glad to do that.

Mr. ZINCKE. That is all.

(The following was furnished for insertion:)

COMPARISON OF REGIONAL FISH HATCHERY SUPERVISORY STAFFS AND WORKLOADS

BRANCH OF GAME FISH AND HATCHERIES [1]

JUNE 30, 1957.

The staff in the regional offices concerned with the operation of fish hatcheries consists of a supervisor, two technical assistants, and a variable number of clerks and stenographers. The supervisor has general responsibility for the details of program operation in all its phases throughout the region. His immediate assistants have had extensive experience in the main elements of hatchery work—fish production, distribution, and maintenance of facilities. Clerical positions are required to handle the processing of fish applications and fish distribution records, and the program administrative functions such as preliminary budget preparation. The other positions provide stenographic and miscellaneous clerical services.

The supervisory staffing patterns are affected by special conditions which may require the employment of more or fewer people in one region than another. These workload factors, taken in their total effect, dictate the manner in which manpower is utilized for most efficient operation.

DESCRIPTION OF WORKLOAD FACTORS

(1) *Number of field personnel.*—The number of field personnel is indirectly related to the size of the regional office staff though not in a direct proportion. In general, the more personnel there are to be supervised, the more clerical and administrative actions which must be taken concerning their employment. A region with a few large stations has relatively less regional office workload per field employee than one which has many small stations.

(2) *Number of field stations.*—In general, the region with the larger number of field stations has the greatest workload, since even the smaller stations require an amount of supervision roughly equivalent to that of the larger stations. If an unusually large number of the stations are old or have difficult problems of water supply or disease conditions, the supervisory assistance from the regional office may be disproportionately high.

(3) *Number of States, and area.*—Since the hatchery program is operated in close conjunction with State fish and game departments, the greater the number of States in the region, the greater is the need for qualified regional office supervisors who can plan cooperative stocking programs and conduct cooperative work with the States. In addition, the regions with the larger geographic area require more travel for supervisors to reach the distant stations.

(4) *Number of applications for fish.*—In general, the greater the number of applications which must be processed, the greater the workload of the regional office. For example, if an application is for a small body of water and requires but few fish, the effort involved in processing it is relatively as great as that which goes into handling an application covering a large number of fish in a large body of water. It is not possible to measure workload by the application load since there are occasional differences which reflect peculiarities of waters to be stocked or unusual problems in servicing and distributing the fish. Moreover, a larger number of hatcheries from which the fish are to be distributed adds somewhat to the workload involved in handling applications.

(5) *Number and weight of fish distributed.*—Trout and salmon normally stocked in streams under management plans which have been developed with the State authorities. The effort involved in processing the distribution of these cold-water species is relatively less on a numbers basis and much less on a weight basis than that required for warm-water fish. Thus, the supervision required to stock 96 million fish—mostly trout and salmon—weighing nearly a million pounds in region 1 is actually much less than that required to plant 13 million fish weighing 243,000 pounds in region 2.

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[1] The Branch of Game Fish and Hatcheries has since been divided into the Branch of Fish Hatcheries and the Branch of Fishery Management Services.

EVALUATION OF REGIONAL OFFICE WORKLOADS

Region I (Portland, Oreg.; States of California, Idaho, Montana, Nevada, Oregon, and Washington)

In this regional office one less employee is required because of the low fish-stocking application load, and because of the fact that field operations are concentrated in large, modern hatcheries. Of the 6 positions in this office, 2 biologists have subsequently been transferred to functions of another branch. However, the lower Columbia River program has furnished the equivalent of 2 man-years of assistance in the supervision of the hatchery program.

Region II (Albuquerque, N. Mex.; States of Arizona, Colorado, Kansas, New Mexico, Oklahoma, Texas, Utah, and Wyoming)

Of the 9 positions in the staff of this regional office on June 30, 1958, 1 biologist position has been transferred to the function of another branch, and 1 position was that of a trainee. This leaves a base staff of seven positions required to service a region with the largest geographical area, and with an application load that is moderate but growing.

Region III (Minneapolis, Minn.; States of Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin)

A normal staffing pattern prevails in this office. As of June 30, 1958, 2 of the 9 positions in the hatchery staff were biologists who have since been reassigned to the Branch of Fishery Management Services, leaving a base staff of 7 positions. A moderate application load is counterbalanced by heavy production needs. The area has the largest angler population of any region.

Region IV (Atlanta, Ga.; States of Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, South Carolina, Tennessee, and Virginia)

The staffing of this office follows the standard staffing pattern with the exception of two additional positions. One of these is responsible for supervision of fish distribution, and the other is a clerical position also required in this activity. There are thus three positions required to service fish applications and distribution work. This region comprises the largest number of States, operates more hatcheries than any other, and processes one-half of the fish applications.

Region V (Boston, Mass.; States of Connecticut, Delaware, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, and West Virginia)

The staffing pattern in this office conforms to normal standards with a total of seven positions. One position on June 30, 1957, was a clerical position subsequently transferred to the Branch of Fishery Management Services. The region ranks fourth in number of stations. Work is carried out in 11 States, and while the application load is moderate, the total production is large. "Legal-sized" trout stocking is an important phase of the program.

Branch of Game Fish and Hatcheries—Comparison of personnel and workloads, as of June 30, 1957

	Regions				
	1	2	3	4	5
Permanent personnel	6	[1]8	9	9	[1]7
Field positions	130	46	49	101	61
Field stations	18	16	20	24	17
Number of States in region	6	8	11	12	11
Number of applications for fish filled in 1956	570	18,617	9,403	36,943	7,526
Number of fish distributed in 1956:					
Warm-water fish	1,150,000	8,613,000	25,137,000	48,337,000	2,237,000
Trout	14,125,000	4,586,000	8,833,000	2,585,000	10,061,000
Salmon	80,897,000				381,000
Weight of fish distributed in 1956 (pounds):					
Warm-water fish	3,632	32,630	15,220	67,168	2,900
Trout	441,300	210,398	216,771	85,394	315,421
Salmon	510,440				2,093

[1] vacancy.

Mr. LENNON. Which of the regions did you say had the greatest number of applications for stocking of ponds?

Mr. JANZEN. I have been under the impression that region IV, Atlanta, had the greatest number. The latest figure from region II, however, was some 60,000 applications this year.

Mr. LENNON. Do you think that region IV has the most?

Mr. JANZEN. I don't know.

Mr. LENNON. You say that is region IV with the 60,000 applications?

Mr. JANZEN. Region II this year had 60,000 applications.

Mr. LENNON. Out of 60,000 applications, how many applications did you have for private lakes or ponds?

Mr. JANZEN. We have a policy whereby our production goes first to federally owned lands.

Mr. LENNON. Just answer the question if you can.

Approximately, out of the 60,000 applications, how many applications had you for private lakes or ponds, in round numbers?

Mr. JANZEN. I am going to go to my assistant here. I understand it is 50 percent.

Mr. LENNON. You say approximately 30,000. Would you tell me approximately, of the 30,000, how many applications were met, that is, that you furnished the stock to these private lakes or ponds?

Mr. JANZEN. On individual farms you are talking about now?

Mr. LENNON. Yes, private lakes or ponds.

Mr. JANZEN. In 1959 we were able to fill about three-fourths of them.

Mr. LENNON. About three-fourths of the 30,000. You know there are a lot of these people who have private lakes and ponds who charge admission to fish in those private lakes and ponds. Is that so or not?

Mr. JANZEN. We do not furnish fish for keeping up fishing on farm ponds. It is only initial stocking.

Mr. LENNON. You furnish them for the initial stocking?

Mr. JANZEN. That is right.

Mr. LENNON. Has your Department ever explored with the Department of Agriculture the possibility of charging some nominal fee for that initial stocking to help defray the cost with the Government making a contribution to the building of the pond itself, or lake?

Mr. JANZEN. With your permission I would like to check again with my assistant, who was here before I came.

I understand it was explored with the Bureau of the Budget and they decided it wasn't practicable to do that.

Mr. LENNON. It wasn't practicable to make any charge for the furishing of the initial stocking of these private ponds or lakes?

Mr. JANZEN. That is right, sir.

Mr. LENNON. That is sort of comparable with other things that are going on all the time.

Mr. GROSS. Will the gentleman yield?

Mr. LENNON. Yes.

Mr. GROSS. Do the States provide fish for stocking purposes?

Mr. JANZEN. In most cases they do not for these farm ponds.

Mr. GROSS. So that is done almost exclusively by the Federal Government?

Mr. JANZEN. That is correct.

Mr. GROSS. You are the Director of the comparatively new Bureau of Sport Fisheries and Wildlife?

Mr. JANZEN. That is correct.

Mr. GROSS. Do you have two assistants?

Mr. JANZEN. Yes, sir.

Mr. GROSS. What are their job descriptions, if I may ask? Are they career people?

Mr. JANZEN. They are career people. Both of them are career people. Both of them are qualified professionally through academic training and have been with the service for many years.

Mr. GROSS. What are their basic job descriptions?

Mr. JANZEN. One of them has a background in the fisheries field and one of them has a background in the wildlife field. Their basic job descriptions pretty well cover my job description.

In other words, either one of them will act while I am out. I am out a great deal of time. They act for me and their job descriptions, when I am gone, are sufficient to cover all of the work and responsibilities.

Mr. GROSS. Are they biologists, researchers, or what?

Mr. JANZEN. Yes, sir; they were biologists when they started with the Fish and Wildlife Service. Now they are administrators with a biological background.

Mr. GROSS. What you are saying to me is that neither of these two assistant directors has a job description of an enforcement officer, is that correct?

Mr. JANZEN. That is correct.

Mr. GROSS. So you downgraded enforcement to that extent?

Mr. JANZEN. No, sir. The job description definitely covers the enforcement responsibilities. It covers all responsibilities and all angles of our management.

Mr. GROSS. However, you don't have a career enforcement man in either position of assistant director?

Mr. JANZEN. That is correct, sir.

Mr. GROSS. Then you have downgraded the position because you did have in past years qualified enforcement officers, didn't you?

Mr. JANZEN. Let's see now. I don't know whom you are referring to who had a career as an enforcement officer that was a director or assistant.

Mr. GROSS. To be specific, wasn't Jesse Thompson an enforcement officer?

Mr. JANZEN. Yes, sir.

Mr. GROSS. He was not a biologist. He was not a research man?

Mr. JANZEN. Yes, sir; Jesse Thompson was the Chief of a branch. He was not the assistant director.

Mr. GROSS. He was chief of enforcement.

Mr. JANZEN. Yes. We have a career officer handling enforcement here on the staff.

Mr. GROSS. I am trying to get at that.

Mr. JANZEN. I have a man with many years of enforcement experience and all his life has been an enforcement officer in charge of enforcement.

Mr. GROSS. However, you have downgraded it to the extent that neither of the assistant directors is an enforcement man?

Mr. JANZEN. The men for assistant director were selected for their administrative ability.

Mr. GROSS. Don't you think that if you are going to spend money and you have made a very fine presentation of the need, in my opinion, for the expenditure of a considerable amount of money to preserve migratory waterfowl and so on and so forth, in order to preserve those stocks that you are going to build up or hope to build up through the spending of this money, you ought to give enforcement its proper place in this table of organization?

Mr. JANZEN. We believe, sir, that enforcement has a very responsible place in our organization and I believe we have it fully staffed as necessary with enforcement men. Our enforcement work actually is carried out of our regional offices. The work in my office is staff work on enforcement and every regional supervisor of enforcement is a career enforcement officer. He has had many years experience.

Mr. GROSS. I will say to you that I would like to see one of these assistant directors strictly an enforcement man because you can spend all the money in the world and unless you can enforce the laws you are not going to have any migratory waterfowl.

Mr. JANZEN. Both of these men have a great appreciation for the need for enforcement.

Mr. GROSS. That may be.

The CHAIRMAN. If you will let me interrupt, are they biologists, or real enforcement officers?

Mr. JANZEN. My two assistants started out as biologists. They have been administrators. One of them had charge of our game fish and hatcheries program for many years. One of them was in our branch of Federal aid, worked for the State of Minnesota for quite a number of years, and he has been in this office here for many years, and both of them have demonstrated their ability in the field of administration. That is one of the things we have to look forward to when we select an administrator. Regardless of his background, whether he is a fisheries man, a wildlife man, enforcement, or he started with the branch of predator and rodent control, or where he may have started, when we get into these jobs of direction we have to look toward their administrative ability.

The CHAIRMAN. You have a chief of enforcement?

Mr. JANZEN. We have a Chief of the Branch of Management and Enforcement and, when he was with the State, he had charge of enforcement. Here he has charge of the overall operations of the Branch, which includes the directing of the work which leads to gathering the information on which regulations are based, and, in addition, in this Branch we have a man in charge of enforcement with a long enforcement background, and he is directly responsible for the enforcement of this Branch's work, but, by having them both in one branch, we are able to closely coordinate our surveys and our enforcement work and the making of regulations, and that is very important. We want the enforcement men to be in on the making of regulations, because regulations have to be practical and the enforcement men give it that test.

Mr. GROSS. Mr. Chairman, will you yield?

The CHAIRMAN. Yes.

Mr. GROSS. What is that gentleman's name?

Mr. JANZEN. Chuck Lawrence. You are talking about the man handling our enforcement?

Mr. GROSS. That is right.

Mr. JANZEN. That is right. Chuck Lawrence.

Mr. ALLEN. Mr. Chairman, may I ask a question?

The CHAIRMAN. Are you finished, Mr. Gross?

Mr. GROSS. Yes.

Mr. ALLEN. To change the subject a little bit, could you tell us whether, in your opinion, the reorganization of the Service under the two bureaus has had any effect, good or bad, on the ability of the Service to carry on the work in the field of sport fisheries or wildlife?

Mr. JANZEN. I will put it this way: The philosophies in commercial fisheries and the philosophies in sport fisheries and wildlife are entirely different. One group entirely services industry and the other group entirely services recreation to the public; so, there is a very definite cleavage, you might say, as far as interests are concerned. I do not believe that splitting the two in any way has weakened the ability of the bureaus to take care of their respective responsibilities. In fact, I think probably it has accentuated interest, especially in the field of sport fisheries, because now it will get special consideration.

Mr. ALLEN. That almost adds up to an improvement?

Mr. JANZEN. Yes; I believe so, sir.

Mr. ALLEN. Thank you, Mr. Chairman.

The CHAIRMAN. I want to go over with you this division of administration in the various regions. Did I understand you to say, notwithstanding what the field load may be, the administrative officers, all through the various regions, would be 22 employees?

Mr. JANZEN. No, sir.

The CHAIRMAN. Wait a minute, then, right there. Here we have region I. You have 18 in the administrative offices and you have 344 in the field. In region II, you have 21 administrative employees and you have only 95 people in the field.

Mr. JANZEN. Sir, the way this table is made up has led to a misunderstanding. I would like to explain this figure, "344." That block, housekeeping and engineering services furnished to units who are operationally supervised by Washington office, does not include all of the people in the region. You have to add all of the people across all the blocks to get the number of people in the region.

As you may know, for example, research has always been directed out of Washington, but the regional offices furnish all of the housekeeping functions, as we call them, administrative services, for those people.

Mr. ZINCKE. Aren't these figures comparable as between regions? In other words, doesn't the 95 figure compare with the 344 figure, whatever additions should be made to them?

Mr. JANZEN. That is as far as the people supervised from Washington are concerned; yes. This does not include any of the people in our fish hatcheries or refuges. This figure of 344 and 95 are people supervised from Washington, but who are just serviced by the regions, as far as administrative services are concerned. They take care of their payrolls, pay their bills, take care of their personnel problems, and so forth, but the technical direction is from Washington. Research has never been decentralized.

Mr. ZINCKE. Aren't the figures comparable as between regions? In other words, if region I has 18 people in the office and 344 shown in the field, do not those figures compare with region II with 21 people in the office and 95 in the field? In other words, aren't the ratios standard, regardless of what additions or subtractions should be made from any of those figures?

Mr. JANZEN. In region I, you have 18 people in the administrative office.

Mr. ZINCKE. Yes.

Mr. JANZEN. Let's start from the right to the left. They service 344, plus 44, plus 1, plus 24, plus 2, plus 130, plus 93, plus 26, plus 149, because you have to add all those together to get the total.

Mr. ZINCKE. That is approximately 750.

Mr. JANZEN. Yes. There is a comparable figure.

Mr. ZINCKE. That is 18 supervising approximately 750. In region II, we have 21 people, and our figure would be about 450 in region II.

Mr. JANZEN. Yes.

Mr. ZINCKE. So, we have 18 people handling 750 people in region I, and we have 21 people handling 450 in region II. Are those figures comparable?

Mr. JANZEN. No.

Mr. ZINCKE. Would you be kind enough to give us comparable figures with respect to those two regions?

Mr. JANZEN. The figures you have given are comparable only in this respect: In region I, which is unique, in Portland, Oreg., there are consolidated services by the Department of the Interior that cover certain phases of administrative services for all of the Department agencies; so, a part of the Portland, Oreg., administrative services, region I, is supplied by these consolidated services. This 18 does not include all of the administrative services in Portland. It does in the other four regions.

Mr. ZINCKE. Regions II and III are comparable?

Mr. JANZEN. Yes, sir.

Mr. ZINCKE. In region II, we said there were about 450 people; is that correct?

Mr. JANZEN. I would have to add that up. I presume it is.

Mr. ZINCKE. Don't take my word for it.

Mr. JANZEN. In region II, there is a total figure of 502.

Mr. ZINCKE. What is the figure on region III?

Mr. JANZEN. It adds up, also, to 502.

Mr. ZINCKE. That is a rather odd coincidence.

Mr. JANZEN. It is, but, if you look at the details, you see it adds up in an entirely different way. I mean the subtotals. I was a bit surprised myself.

Mr. ZINCKE. How about region IV?

Mr. JANZEN. Region IV had 590.

Mr. ZINCKE. And in region IV it took 18 people to handle 590, and in region III it took 22 people to handle 502, and in region II it took 23 people to handle 502. Are those figures comparable?

Mr. JANZEN. Yes, sir; they should be.

Mr. ZINCKE. Can you give us any explanation for the discrepancy in the number of supervisory employees in those three districts?

Mr. JANZEN. Comparing regions III and IV?

Mr. ZINCKE. II, III, IV.

Mr. JANZEN. Region II is 23 to 502; region III is 22 to 502; and region IV is 18 to 590.

Mr. ZINCKE. Five people less in region IV than in region II, handling 88 people more.

Mr. JANZEN. I count 24 people here in region IV. Am I in error?

Mr. ZINCKE. I am omitting, throughout, the administrative officers, assistants, and secretary. I am trying to do that all the way down the line. I assume that those are standard.

Mr. JANZEN. No; they are not standard.

Mr. ZINCKE. There are 3 employees in region IV, 2 employees in III, and 2 employees in II.

Mr. JANZEN. I have 6 here in IV; an administrative officer, an assistant, a secretary, and 3 employees.

Do I have the same table?

Mr. ZINCKE. Are 3 employees added to those 3?

Mr. JANZEN. I think you are probably right.

Mr. ZINCKE. I don't know. I am asking.

Mr. JANZEN. I think you are right. I was mistaken. It is 3 employees and 4 in II and 2 in I.

Mr. ZINCKE. Will you give us a detailed breakdown on all of these items with respect to all of the regions on a comparable basis?

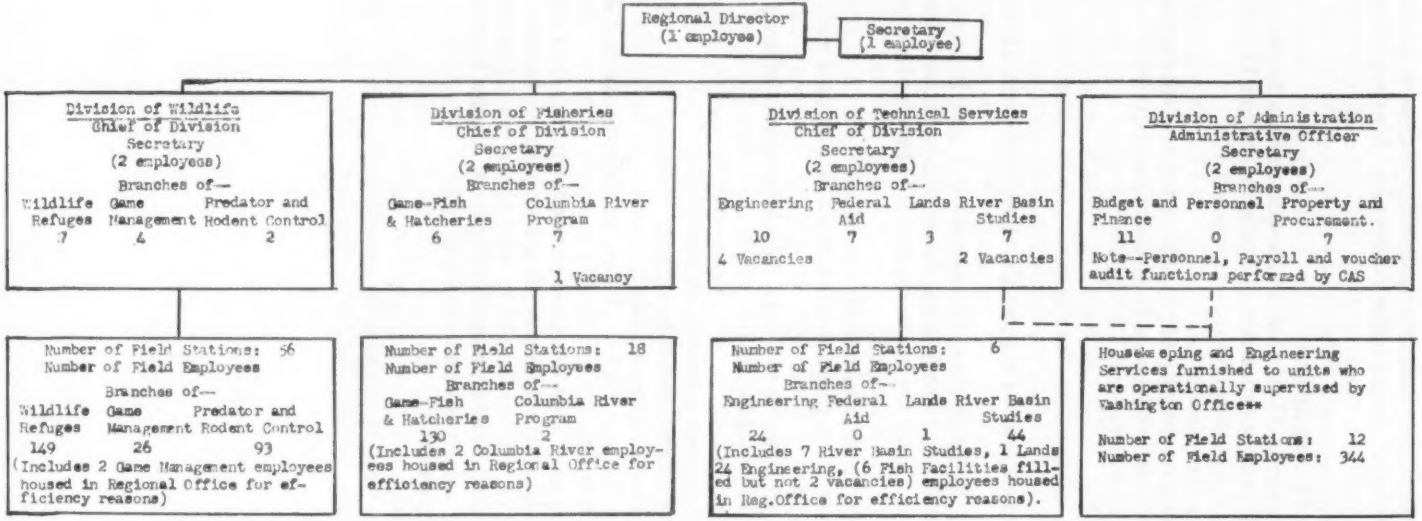
Mr. JANZEN. Yes. You are interested in why there would be more people in one region than another considering they might have the same workload. Is that what you are interested in?

Mr. ZINCKE. That is correct.

Mr. JANZEN. All right.

(The following tables were furnished for insertion:)

REGION 1* -- U. S. FISH AND WILDLIFE SERVICE
PERMANENT PERSONNEL LOCATION CHART
As of June 30, 1957



Total Regional Office Personnel 81 (7 vacancies not included)
Total Field Employees (Includes those operationally supervised by Washington Office) 813 (Does not include any vacancies)
Total Permanent Employees, Region 1 894

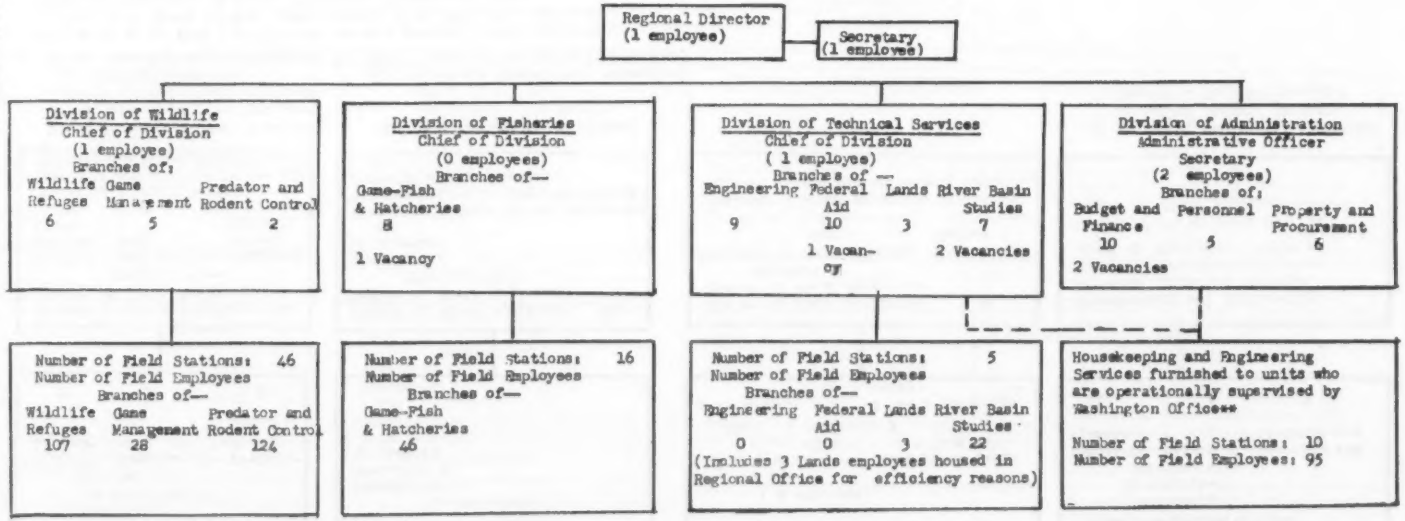
*Region 1 - U. S. Fish and Wildlife Service geographically includes states of — Washington, Oregon, California, Montana, Idaho and Nevada.

** Branch of Commercial Fisheries
Branch of Fishery Biology
Branch of Alaska Fisheries
Branch of Wildlife Research

Region 2* - U. S. Fish and Wildlife Service

21168—58——17

Region 2* - U. S. Fish and Wildlife Service
PERMANENT PERSONNEL LOCATION CHART
As of June 30, 1957

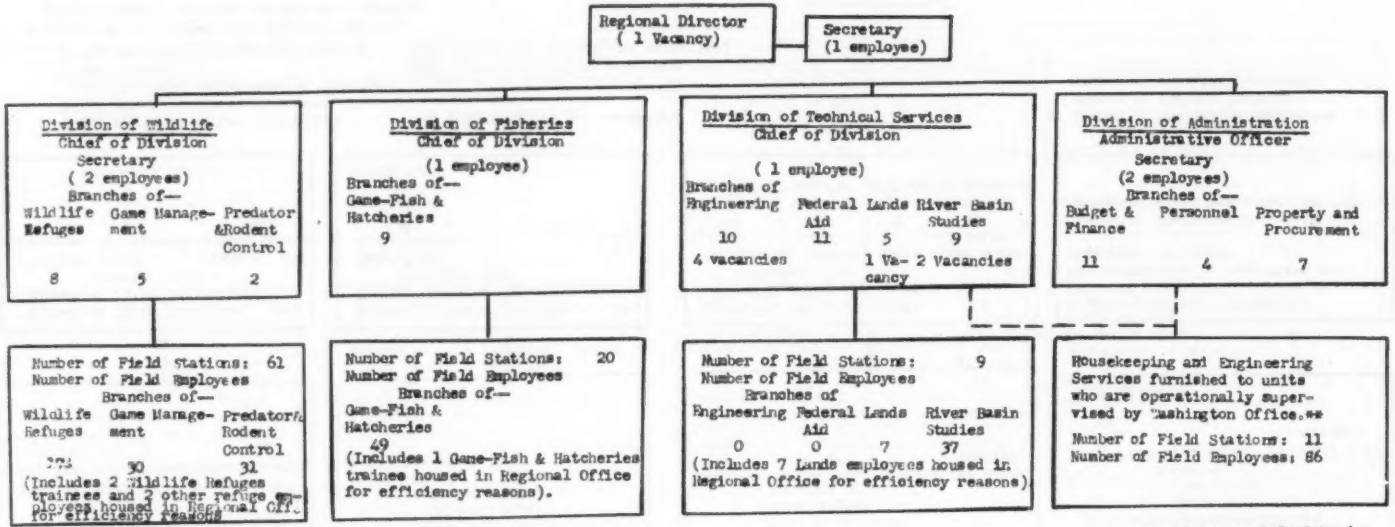


Total Regional Office Personnel	77	(6 vacancies not included)
Total Field Employees (Includes those operationally supervised by Washington Office)	425	(Does not include any vacancies)
Total permanent employees, Region 2	502	(Does not include any vacancies)

* Region 2- U. S. Fish and Wildlife Service geographically includes states of - Wyoming, Utah, Texas, Kansas, Arizona, New Mexico, Colorado and Oklahoma.

** Branch of Commercial Fisheries
Branch of Fishery Biology
Branch of Wildlife Research

REGION 3* - U. S. Fish and Wildlife Service
PERMANENT PERSONNEL LOCATION CHART
As of June 30, 1957



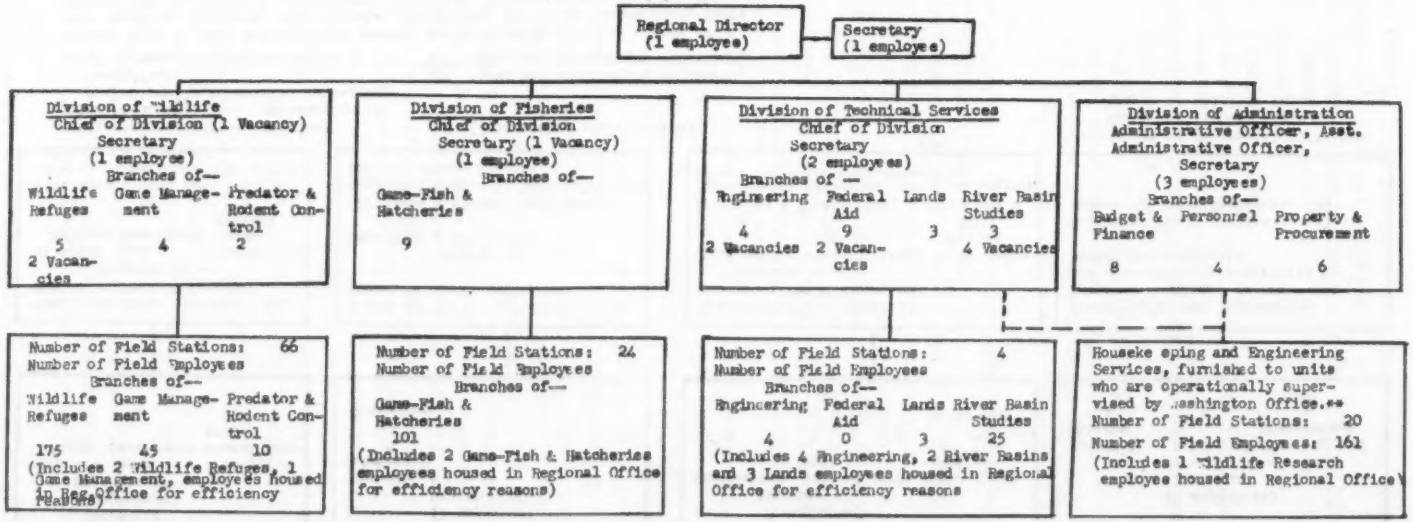
Total Regional Office Personnel 88 (8 Vacancies not included)
Total Field Employees (Includes those operationally supervised by Washington Office) 414 (Does not include any vacancies)
Total Permanent Employees, Region 3 502 (Does not include any vacancies)

*Region 3- U. S. Fish and Wildlife Service geographically includes states of — North Dakota, South Dakota, Iowa, Nebraska, Minnesota, Missouri, Wisconsin, Michigan, Illinois, Indiana and Ohio.

** Branch of Commercial Fisheries
Branch of Fishery Biology
Branch of Wildlife Research

REGION 4* - U. S. Fish and Wildlife Service

REGION 4* - U. S. Fish and Wildlife Service
PERMANENT PERSONNEL LOCATION CHART
As of June 30, 1957

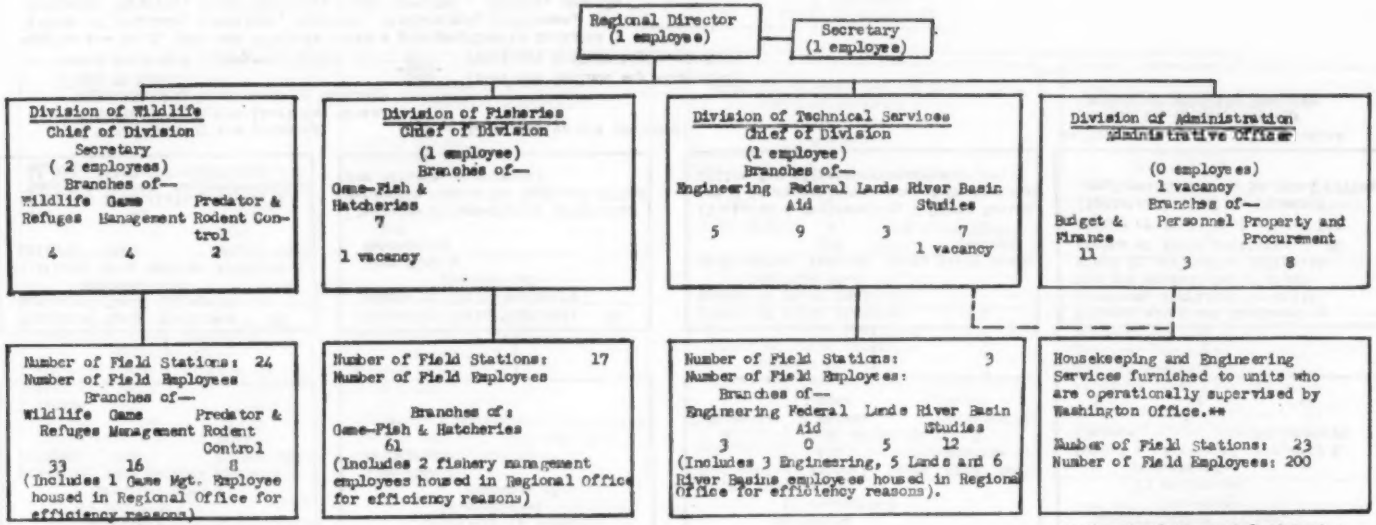

Regional Director (1 employee)
Secretary (1 employee)
Division of Wildlife
Chief of Division (1 Vacancy)
Secretary (1 employee)
Branches of—
Wildlife Refuges 5 2 Vacancies
Game Management 4
Predator & Rodent Control 2
Number of Field Stations: 66
Number of Field Employees
Branches of—
Wildlife Refuges 175
Game Management 45
Predator & Rodent Control 10
(Includes 2 Wildlife Refuges, 1 Game Management, employees housed in Reg Office for efficiency reasons)
Division of Fisheries
Chief of Division
Secretary (1 Vacancy)
(1 employee)
Branches of—
Game-Fish & Hatcheries 9
Number of Field Stations: 24
Number of Field Employees
Branches of—
Game-Fish & Hatcheries 101
(Includes 2 Game-Fish & Hatcheries employees housed in Regional Office for efficiency reasons)
Division of Technical Services
Chief of Division
Secretary (2 employees)
Branches of —
Engineering 4 2 Vacancies
Federal Aid 9 2 Vacancies
Lands 3
River Basin Studies 3 4 Vacancies
Number of Field Stations: 4
Number of Field Employees
Branches of—
Engineering 4
Federal Aid 0
Lands 3
River Basin Studies 25
(Includes 4 Engineering, 2 River Basins and 3 Lands employees housed in Regional Office for efficiency reasons
Division of Administration
Administrative Officer, Asst. Administrative Officer, Secretary
(3 employees)
Branches of—
Budget & Finance 8
Personnel 4
Property & Procurement 6
Housekeeping and Engineering Services, furnished to units who are operationally supervised by Washington Office.**
Number of Field Stations: 20
Number of Field Employees: 161
(Includes 1 Wildlife Research employee housed in Regional Office)

Total Regional Office Personnel 66 (12 vacancies not included)
Total Field Employees (includes those operationally supervised by Washington Office) 524 (Does not include any vacancies)
Total Permanent Employees, Region 4 590 (Does not include any vacancies)

*Region 4— U. S. Fish and Wildlife Service geographically includes States of Arkansas, Louisiana, Maryland, Mississippi, Tennessee, Kentucky, Virginia, North Carolina, South Carolina , Alabama, Georgia and Florida.

** Branch of Commercial Fisheries
Branch of Fishery Biology
Branch of Wildlife Research

Region 5* - U. S. Fish and Wildlife Service
PERMANENT PERSONNEL LOCATION CHART
As of June 30, 1957



Total Regional Office Personnel 69 (2 vacancies not included)
Total Field Employees (Includes those operationally supervised by Washington Office) 338 (Does not include any vacancies)
Total Permanent Employees Region 5 407 (Does not include any vacancies)

* Region 5- U. S. Fish and Wildlife Service geographically includes states of West Virginia, Delaware, Pennsylvania, New Jersey, New York, Connecticut, Rhode Island, New Hampshire, Massachusetts, Maine and Vermont.

** Branch of Commercial Fisheries
Branch of Fishery Biology
Branch of Wildlife Research

Mr. GROSS. May I just get one more thing clear. I understand that you have only 128 game agents.

Mr. JANZEN. That is correct, in the United States.

Mr. GROSS. Does that include any of this organization in Washington?

Mr. JANZEN. No, sir.

Mr. GROSS. Those are men actively in the field?

Mr. JANZEN. That is right.

It does not include regional office people, either.

Mr. GROSS. Only 128?

Mr. JANZEN. Only 128, that is right.

Mr. GROSS. That is all, Mr. Chairman.

The CHAIRMAN. They handle most of your migratory birds and sport fisheries? They supervise both migratory birds and sport fishing?

Mr. JANZEN. As far as any enforcement acts are concerned that have relation to sport fishing, yes.

The CHAIRMAN. In the off-season what do they do?

Mr. JANZEN. These enforcement men, first of all, work very closely with the State conservation department officers. As an average I would say there must be around 50 State officers to 1 Federal officer. One of their jobs is to secure the full cooperation of the State in the enforcement of our regulations. The States in most cases adopt our regulations, so they are in a position to closely cooperate in the enforcement of our regulations.

Therefore, during the off-season, among other things which I will explain, they do spend considerable time with State officers helping them with their State enforcement problems, and also working out interstate violation problems. It is kind of a reciprocal cooperative sort of thing. They also work with the State officers going over their problems of enforcing and interpreting the migratory waterfowl regulations, so that they can call upon these people during the rush waterfowl season. We have found that it is necessary they spend as much time as possible working with State officers.

Second, we have quite a load of propagating permits, scientific collecting permits and other kinds of permits, and the enforcement officers are supposed to pass on these and check on them.

In the summertime we detail quite a number of agents to Canada on our breeding-ground surveys. We find that is good for the enforcement officers to round out their training and we find it very valuable in the kind of assistance that they give in doing our banding work, in working out our production studies, and carrying out, in the wintertime, our winter inventories. They are busy people the year around.

The CHAIRMAN. Are there any other questions?

Mr. ALLEN. Mr. Chairman.

The CHAIRMAN. Mr. Allen.

Mr. ALLEN. Who enforces the game laws in national parks, for example?

Mr. JANZEN. The State, because the State law prevails as far as fish and game are concerned on national forests.

Mr. ALLEN. Does the State do that through the National Park Service ranger?

Mr. JANZEN. You said national forests, or national parks?

Mr. ALLEN. National parks.

Mr. JANZEN. Excuse me. Enforcement in national parks is done by the National Park Service.

Mr. ALLEN. And that means the Federal laws and the State laws are enforced by the National Park Service rangers?

Mr. JANZEN. That is correct for areas under the jurisdiction of the National Park Service.

Mr. ALLEN. In the national forest areas?

Mr. JANZEN. In the national forest areas the State enforces the law.

Mr. ALLEN. In lands owned by the Federal Government generally, outside the national parks, who enforces the law?

Mr. JANZEN. The State fish and game departments, because, generally speaking, it is the State fish and game laws that prevail on these lands.

Mr. ALLEN. Thank you.

Mr. JANZEN. Even on our own Federal national wildlife refuges we cannot promulgate a regulation that would liberalize a State regulation. In other words, we abide by the State regulations on our national wildlife refuges.

Mr. ALLEN. Then does it add up to the fact that except in the national parks wherever you have an interest the State also has an interest in the enforcement of game laws?

Mr. JANZEN. Yes, but as far as migratory birds are concerned we have the primary responsibility for enforcement of the regulations; however the bulk of regulations on national forests have to do with resident wildlife. I don't want to leave the impression that only the State has responsibility on migratory birds on national forests. They would have the same responsibility on national forests as they would have on your farm, for example.

Mr. ALLEN. What I am getting at very bluntly is that if we have both Federal and State game wardens in a given area, then the taxpayers are paying for two where one could serve; is that not correct?

Mr. JANZEN. Of course our primary responsibility, our only official responsibility, you might say, is to enforce Federal laws. That is the responsibility of our agents. The States don't in toto accept all of our Federal laws so we have to have Federal enforcement officers. Also to help get cooperative enforcement out of the State enforcement men we have to have our men there to help them interpret the regulations so they are enforced as uniformly as possible in all the States. I think that one of the basic reasons why migratory-bird management was finally turned over to the Federal Government, was because the 48 States simply couldn't agree on anything uniform. With the birds moving from one State to the next each State was interested in those birds only while they were within their boundaries.

Mr. ALLEN. If you can put it percentagewise, what percent of the Federal laws are not included also in State laws so far as enforcement problems are concerned?

Mr. JANZEN. I am advised that about 35 of the 48 States have completely accepted our regulations as their own regulations, so in those States they could be enforced by State wardens. Of the rest, some have minor variations. We would have to make a detailed analysis State by State to determine just how they vary, because they also vary from year to year. A State legislature may decide that they don't

want to have this particular regulation or that. They may even make it impossible for the State conservation department to promulgate a regulation that would be the same as ours.

Mr. ALLEN. Then would it be true to say that with the exception of these minor variations the enforcement of the State laws would include to the degree of almost 100 percent enforcement of Federal laws?

Mr. JANZEN. Almost; that is right.

Mr. ALLEN. Thank you.

The CHAIRMAN. Thank you very much.

The next witness is Mr. Gottschalk.

Mr. JANZEN. Mr. John Gottschalk will give the sport fisheries part of our program.

STATEMENT OF JOHN S. GOTTSCHALK, CHIEF, DIVISION OF SPORT FISHERIES, FISH AND WILDLIFE SERVICE

Mr. GOTTSCHALK. Thank you, Mr. Chairman.

The CHAIRMAN. We would like you to give your background for the record.

Mr. GOTTSCHALK. My name is John S. Gottschalk. I am a native Hoosier, born in Indiana 45 years ago, and was educated in that State. I am a graduate in biology from Earlham College, at Richmond, Ind., and have a master's degree in zoology from Indiana University. I began work in this field in 1930 as a laborer and lifeguard for the Indiana Conservation Department, and worked summers for that agency. After I graduated from college, I joined the Indiana Conservation Department in its educational work.

In 1937 I became the assistant superintendent of fisheries for Indiana, and the next year I became superintendent of fisheries. In that job I was responsible for the general fisheries work and the supervision of the State hatcheries. I continued in this position until 1941.

After the war I joined the Fish and Wildlife Service and was sent to Billings, Mont., as a member of the staff of our Missouri River Basin Studies organization as fisheries biologist. Later I became assistant supervisor in that office and finally supervisor, and in 1951 I was transferred to Washington where I was placed in charge of the Federal aid in fish restoration program, well known as the Dingell-Johnson program. I was in that position as Assistant Chief of the Branch of Federal Aid until November of this past year, when I was placed in my present position of Chief of Division of Sport Fisheries.

Mr. ALLEN. May I ask one question?

Mr. GOTTSCHALK. Yes, sir.

Mr. ALLEN. You didn't even refer to problems of enforcement. So far as I know you haven't. Were they included anywhere along the line of your experience?

Mr. GOTTSCHALK. When I was in Indiana, sir, all of the employees of our office were deputized as game wardens and I carried a deputy game warden badge for many years, but to be perfectly honest for Mr. Gross' benefit, I never made a case. I went along with the wardens many times.

Mr. GROSS. That is a question I certainly would have asked.

Mr. ALLEN. Thank you.

Mr. GOTTSCHALK. I would like to draw your attention to one question which has to be recognized in a discussion of sport-fisheries work at the Federal level in contrast with our work with migratory waterfowl.

As you are well aware, our waterfowl program is based on Federal laws which vest in the United States Government the responsibility for research and management affecting these birds which are actually governed by treaties between the countries of Canada, United States, and Mexico. In the fisheries field we are not so definitely and distinctly in the management business. We are in a sense in many of our operations assisting the States in work for which they have a primary responsibility. That is the day-to-day management of the sport fisheries and in some cases the commercial fishery resources within their borders.

In some respects, as I say, the work that we are carrying out parallels State work. We have attempted to work with the States very closely all the way down the line in order to avoid duplication, to see to it that our work complements theirs or that we work on regional problems rather than on the strictly local or State problems.

With that much of a background, Mr. Chairman, I would like to have your permission to proceed with a few slides to illustrate the balance of my remarks about our sport-fisheries program.

The 1956 Fish and Wildlife Act recognized sport fishing as a recreational outlet for the American public. We have many statistics which bear on the general question of how many people enjoy the various types of sports but as far as outdoors sports go, we are confident that sport fishing outnumbers all other types of outdoor recreation.

There are some 10 million bowlers in the United States and there are about 12 million people who enjoy the sport of hunting in America, but our survey of 1955 showed that there were 21 million Americans who participated in the sport of fishing in that particular year.

These, mind you, are people who are 12 years or older. The figures don't take into account the young fellows under 12, the kids, who do make up a fairly sizable portion of our sport-fishing population.

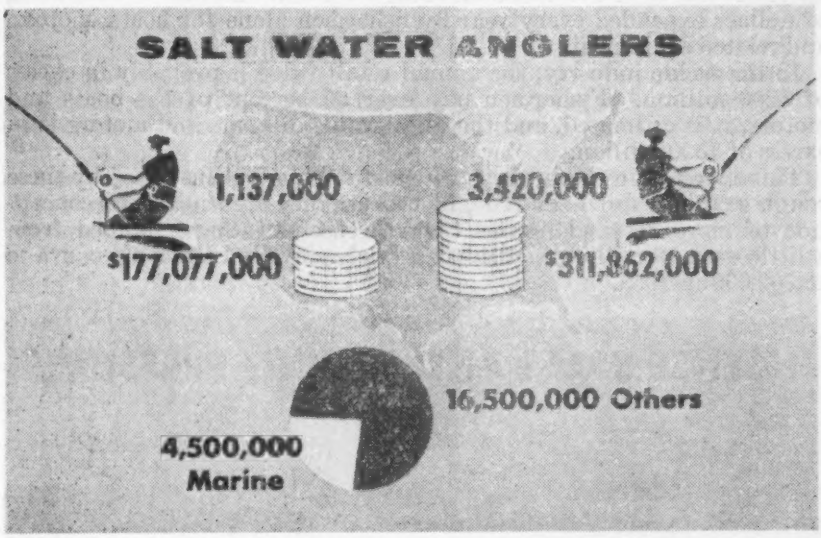
Our fishermen cover almost every class of people in America. We find a man fishing in a trout stream in Wisconsin. He may be a doctor. He may be a leading businessman. He may be a laborer driving all the way from Washington to go down to the outer banks of Carolina to enjoy a little surf fishing, or he may be in a charter boat off Oregon Inlet.

Fishermen come from all classes of people and they are coming in greatly increasing numbers. This is a scene taken on Puget Sound and gives some indication of the tremendous growth and popularity of salt-water sport fishing in America.

With our tremendously booming population increases, people have had to turn more and more to our coastal areas for their fishing recreation. This is one of our most important areas for sport fishing and one of the areas in which we have a very great interest with our sister agency, the Bureau of Commercial Fisheries.

All of these species [slide], ranging from the bluefin tuna, the striped bass, the sailfish, and the tarpon, the yellowtail in California, striped bass in the San Francisco Bay area and the salmon, various species of them, are extremely important in the growing popularity of salt-water sport fishing.

Our 1955 survey shows that there are about 4½ million people who enjoy this particular type of outdoor recreation. They are distributed, as you see on this chart [slide], in the ratio of about 3/4 on the east and gulf coasts and the balance on the Pacific coast.



Salt water anglers amount to 21.4 percent of all anglers over 12 years of age. (1955 data.)

At this point, Mr. Chairman, I would like to refer to the discussion which took place the day before yesterday before this committee when Mr. McKernan and Mr. Young discussed to some extent the problem of the estuaries and the effect of manmade developments and improvements on these estuaries. It was pointed out that these coastal areas, which are sheltered by reefs and bars, are essential for different types of commercial fish. It is important for the record to show also that some of these areas are extremely important for many different kinds of sport fish.

The tarpon, for example, spends its early stages in these semisalt-water areas. Of the other species, the weakfish, the snook, and I could name a large list of species, which also depend upon these estuarine areas.

Moreover, although this is out of my field to some extent, I should like to point out that they are equally as important in many areas for wildlife. In the southern areas, particularly, these estuaries support the winter populations of our migratory waterfowl. We do have a big responsibility to manage these areas and to learn how to manage these areas most effectively for the protection and development of both our sport fisheries and our wildlife as well as our commercial fisheries.

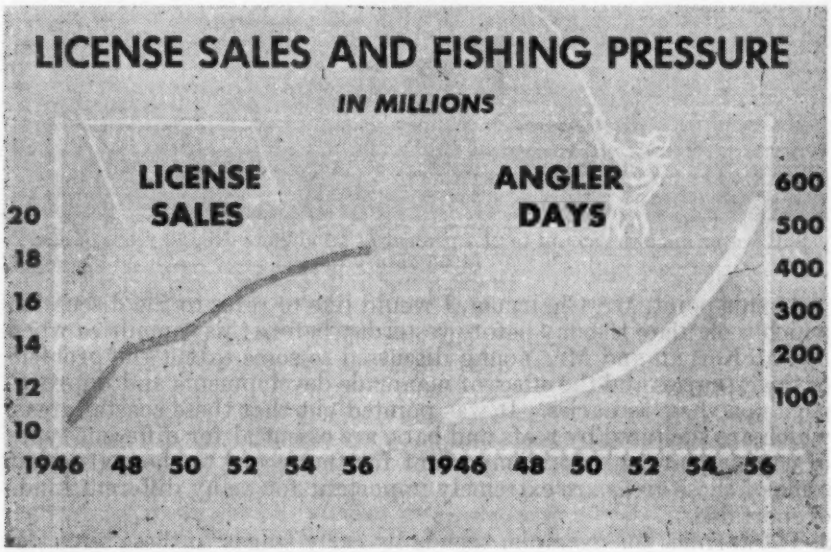
We need to remember, also, that there is a tremendous commercial investment which is based upon our sport fisheries in America.

This [slide] is a boat dock at the mouth of the Umpqua in Oregon. There are thousands of dollars invested in fishing boats. This is a party boat which some man has developed to take anglers out salmon trolling in that area. We find this taking place all over America.

This is a scene down in Tennessee where 20 years ago there was water in rivers, but nowhere else, and now we have a vast empire of fishing opportunity in the State of Tennessee in the Corps of Engineers and the TVA reservoirs. The development in boats for fishermen has come to be a tremendous thing with millions, literally millions, of dollars expended every year by fishermen alone for boats, motors, and related equipment.

In the tackle industry, the annual retail value is probably in excess of $200 million. Fishermen buy over 50 percent of the boats and motors, it is estimated, and the retail value of boats and motors is in excess of $350 million.

This increase in the interest, in sport fishing, is illustrated by these rough graphs—and I say "rough" because they are the artist's conception of more detailed figures. Our license sales have jumped from a little over 10 million in 1946 at a fairly rapidly increasing curve to 18,700,000 in 1955.



Fishing license sales increased steadily from 1946 to 1955. The total number of days American anglers of more than 12 years spent fishing in 1955 was 400 million. The curve showing angler-days is based on this figure and license sales for prior years.

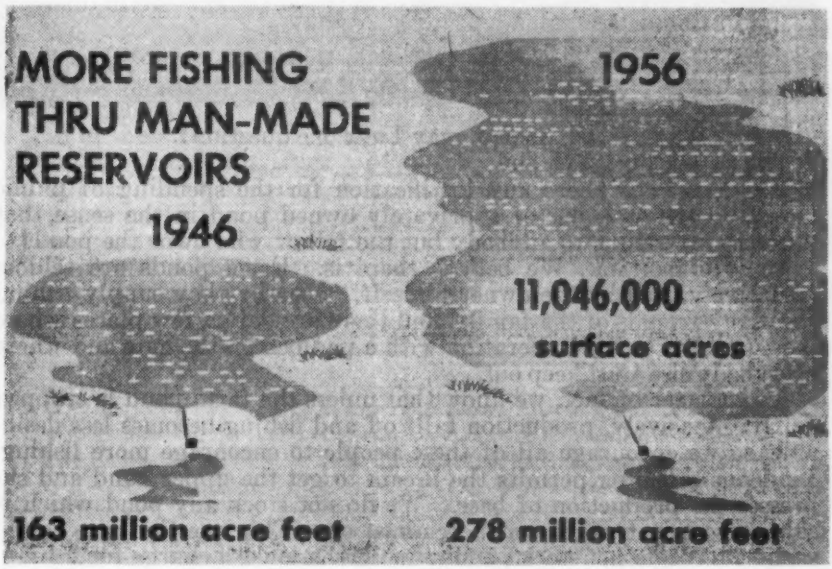
The number of days which these eighteen-million-odd fishermen spend in the pursuit of their sport has gone up at an even greater rate. The reason for this is that people have more leisure time. We have the 40-hour week and there is talk of less than a 40-hour week, so we don't know where that curve is finally going to go. As a matter of fact, it stops as far as our figures go, at 400 million man-days in 1955. From here on out it is guesswork, but will it continue to go up at the same rate? Will it taper off? All we know is that there has been a tremendous boom in angling in America.

Part of this boom has been due to the opportunities made possible through the construction of multiuse projects such as this one [slide], the Shasta Dam in California. As I mentioned earlier, much of it

is due also to the transfer of interest to the coastal areas, but these big multipurpose reservoirs have produced fishing opportunities in many areas.

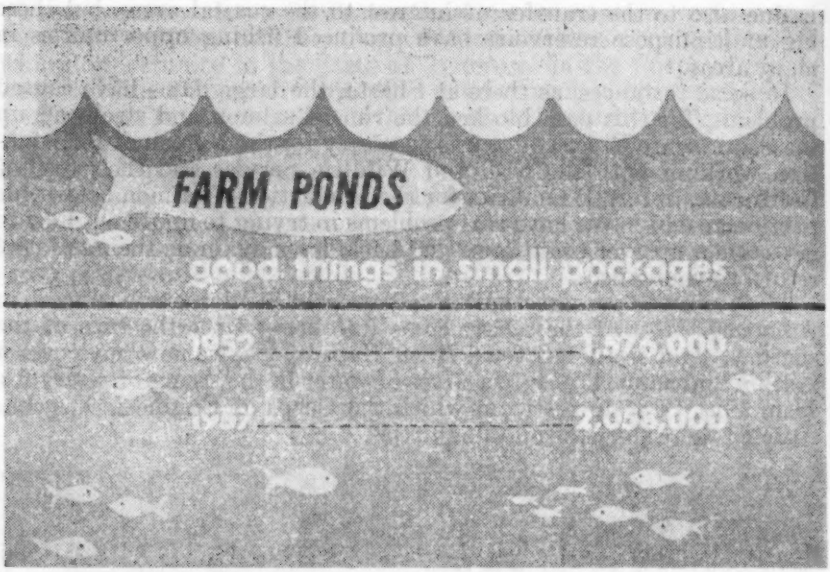
In some instances, as there at Shasta, the large dams have caused problems, for this dam blocked the run of salmon and steelhead up the Sacramento River and it was necessary for the Bureau of Reclamation working with the Fish and Wildlife Service and the State of California, to install facilities for the production of salmon below this particular dam. We have real problems in trying to figure out how to get salmon up over these dams and back down again on their seaward return as young fish.

The reservoir resource now totals over 11 million surface acres in America. Most of these have come into being since the turn of the century. Out in the Missouri River Basin alone, we now have over a million and a quarter surface acres of water in the string of reservoirs from Fort Peck downstream which the Corps of Engineers has constructed there since the middle thirties.



Another very important source of increased fishing opportunity is in our farm ponds. These were discussed briefly a bit earlier in this hearing. They have great importance not only for fishing, but also for wildlife, for recreation through swimming, and many times serve as water supplies for fire protection and other purposes.

The Soil Conservation Service advises us that we now have over 2 million of these farm ponds in America. They are small, but they are manageable. We can get, under proper management, production exceeding 300 pounds per acre out of these small ponds. Not all farm ponds are managed and I do not mean to imply that we do get that kind of production out of all of those ponds. But under good management it is possible to develop fishing which is of primary interest to young fellows who are just getting started in the out-of-doors [slide].



Mr. ALLEN. Mr. Chairman, may I ask one question?

The CHAIRMAN. Yes, sir.

Mr. ALLEN. Is there any justification for the spending of public money in the stocking of a privately owned pond in the sense that it reaps any return to anybody but the fellow who owns the pond?

Mr. GOTTSCHALK. We believe there is. Farm ponds are seldom exclusively used by the owner himself. Usually they supply fishing for many friends of the family, and there are only a few places where it is strictly a private operation with a padlock on the gate and where everybody else must keep out.

As a matter of fact, we know that unless the farm pond is cropped fairly intensively, production falls off and fishing becomes less desirable, so we encourage all of these people to encourage more fishing. Inadequate fishing permits the bream to get the upper hand and supresses the production of bass. We do not stock any pond which is subject to any type of commercialization. This question was raised earlier. We do not stock ponds where they make a charge for fishing, whether it be the initial stock or any other.

It is true that if they come along 2 or 3 years after we have placed some bass or bream in that pond, and they decide that they are going to put a sign up and charge 50 cents a day, there is nothing we can do at that point to stop them, but we believe that there are generally fairly broad public benefits from the small amount of fish which we place in any individual farm pond.

Mr. GROSS. You could have an agreement when you originally stock a pond that it would not be used for commercial purposes and you could have the right to recapture it if it was. It would be that simple, wouldn't it?

Mr. GOTTSCHALK. We could have an agreement but the expenditure of our funds which would be required to recapture those fish would be many times the cost of the fish that went in there.

Mr. GROSS. I doubt that.

Mr. GOTTSCHALK. I believe that we could document those figures. It would require trucks going out from our central locations with a crew of men, and it would be a very difficult operation.

Mr. SANTANGELO. Wouldn't the agreement that you would take over if they made a charge deter the owner of the pond from making the charge?

Mr. GOTTSCHALK. It is quite possible that it would have that effect in some cases. It possibly could.

I have been talking here briefly about expanding opportunities for sport fishing. We have many factors which are affecting our sport fishery resource which are not of the same type. Actually, there is some doubt if our total sport fishery resource, our water base that we fish in, has expanded outside of the coastal areas. The reason, of course, is that we are in an age of increasing competition for water. We are using more water all the time for our human population for just drinking and bathing purposes. Domestic requirements have gone up tremendously.

In addition to that, we have great demands made by all sorts of new industries for tremendous quantities of good, clean water. Industries and municipalities continue to utilize water for the dilution of sewage, transporting their wastes away from where people are living.

All of these things have had a depressing effect on our sport-fishing potential. I use this scene on the Willamette River [slide] merely as an example of something which could be going on in many other parts of the United States and to illustrate the fact that all is not quite as rosy as I may have painted it with my earlier discussion of some of our increased opportunities.

Irrigation in the West in many areas becomes a serious problem when whole rivers of water are diverted from their natural channels into canals for transport downstream [slide]. We cannot deny industry water. We cannot deny agriculture water. Our biggest problem many times is to find ways in which we can integrate our needs for sport fishing with these other uses which man makes of his water.

Our sport fisheries activities consist of three main phases: Branches of Fish Hatcheries, Fishery Research, and Fishery Management Services.

Our fish hatcheries are the thing which most of you know the best. Some of our hatcheries have been in operation since before 1901, as I understand it, and of course, some of the earliest responsibilities of the old Bureau of Fisheries and the old Commission of Fisheries many years ago were for the propagation of food fishes in America. At the present time we have either built or under construction 98 stations that annually produce 1.8 million pounds of fish, constituting approximately 185 million fish.

Our research activities are concentrated in nine field stations and laboratories scattered from Cortland N. Y., to Seattle, Wash. Primarily, they are oriented toward the solution of problems of production of fish in hatcheries. In other words, we consider our research a kind of work that is needed in order to guide our hatchery program.

We also do basic research work in management problems. The actual management—and we differentiate between research and management by saying that management is the application of facts which

research produces—again is related primarily to our hatchery program.

We are well aware that it is not enough to get the fish into the hatchery truck and then to count them up and make a record of fish produced. The important thing is to get the fish into the water in such condition and in such size and at such time of year that they will live to grow and be caught and be the source of a recreational experience for some individual.

This is a scene of a typical cold-water fishery station, not the most modern design, but it does exemplify this particular aspect of our program [slide]. These cold-water stations are scattered throughout the northern part of the country and in the mountainous areas where we have trout.

Mr. YOUNG. Before you get away from the hatchery proposition, I believe you showed 98 hatcheries there.

Mr. GOTTSCHALK. Yes.

Mr. YOUNG. What percentage of those are fresh water and what percentage are salt water?

Mr. GOTTSCHALK. Except for our salmon hatcheries which are a little bit different, that is, neither quite fresh nor salt, we are operating at the present time no salt-water hatcheries.

Mr. YOUNG. That is the point I want to make. Actually, really the only and certainly the best salt-water hatchery would be in the natural hatcheries in the back bays and lagoons.

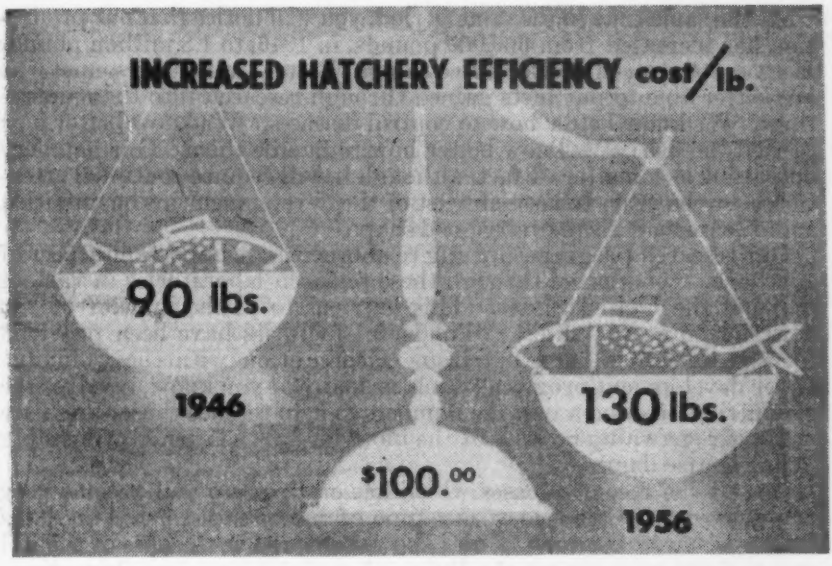
Mr. GOTTSCHALK. That is correct.

Mr. YOUNG. I believe you would agree that we are passing up a bet if we don't make it possible for these various species of a marine life to get in and out of these natural salt-water hatcheries.

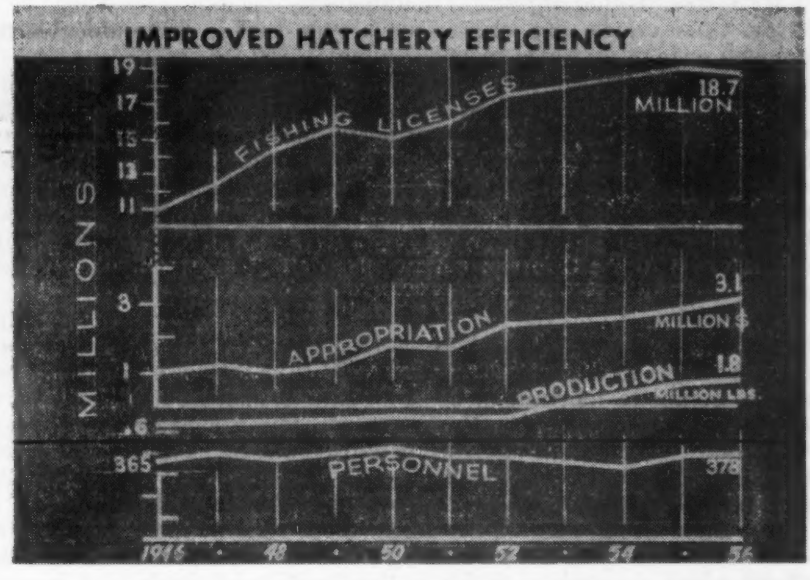
Mr. GOTTSCHALK. Those lagoons that you speak of are very vital to all of our fishery resources.

This is a typical warm-water hatchery [slide]. This hatchery employes a method of producing fish which might be termed "extensive;" that is, we have big ponds with mud-bottoms, which we depend on for a natural food supply to grow the fish, whereas a salmon or trout hatchery is an intensive operation where we need artificial foods, ground-up beef liver and other material of that sort.

We take some pride in the improvement of our hatchery fish in the past few years. We think it does reflect the application of research findings and the better training which we are able to give our men. Today we are producing 130 pounds of fish, constituting an average of 13,000 individual fish, where in 1946, the same amount of money would produce only 90 pounds of fish.



This chart gives the story of our hatchery situation. Our personnel shown on the bottom line has stayed virtually the same for the past 10 years. We have gone from 365 permanent personnel to 378. The Congress has recognized continuously, the need for production of fish with appropriations, as demonstrated by this appropriation graph, which shows that appropriations have gone up approximately three times.



At the same time in the same period, you will notice that our production has increased from 600,000 pounds, in 1946, to 1.8 million pounds in 1956. Again, this reflects two things: Better trained personnel who are better able to put facts gained through research into these operations. We know better how to control diseases. We know better how to feed the fish. We know better how to handle them. Our hatchery operation, as a matter of fact, although it will require continual attention over the years to keep abreast of the development in the nutrition and disease fields, is in pretty good shape.

Our research program, turning to another most important aspect of our work, is conducted through these research laboratories in various parts of the United States. This happens to be the interior of our newest laboratory [slide]. Wonderful facilities have been provided for research on salmon nutrition in connection with the Columbia River development program which, as many of you know, involves the production of salmon in large numbers to help replace those which are no longer spawning because of the blockades in the rivers by these big hydroelectric dams.

One of the recent diseases which has cropped up and become very damaging on the west coast is a type of tuberculosis, fish TB. This little specimen of salmon [slide] shows some red at the base of the gill and perhaps you can see the little red flecks at various other places, which are the external symptoms of a disease which has wrought havoc in many hatcheries on the west coast.

Like a lot of human diseases, we don't have the answer for all of them. They pop up and it requires a lot of concentrated effort to get the answers. We have not found the answers for fish tuberculosis yet, although we have instituted prophylactic measures which are helping to reduce the severity of the attacks.

Mr. GROSS. Is that applicable to humans?

Mr. GOTTSCHALK. No, this is not a type that is communicable to humans, or to other warm-blooded animals.

There is another type of disease which we know very little about caused by a small agent called a vibrio, which is smaller than bacteria, yet larger than a virus. You will notice here again the bloody spots on these young pink salmon [slide]. I mention that only to point out the fact that we get into some extremely complicated problems on this disease business. We don't have the background of medical history in fish diseases that we have in human disease and in many of these things we are groping in the dark attempting to find the answers.

Sometimes we find the answer and it backfires. Furunculosis, not to use a too technical term here, is the name of a very serious trout disease which occurs both in the wild and in hatcheries. It can cause almost complete mortalities of trout and salmon, but a few years ago with the advent of sulfa drugs, we found that some of them were quite effective in controlling furunculosis. Through a series of experiments we began to use it, but then we found that we were getting bad results after utilizing one in particular, sulfamerazine.

The same thing was happening in trout that happens in humans sometimes when you use sulfa drugs. There are after effects or side effects which are serious as far as the function of the kidney is concerned. This is a microscopic section, a thin section through a piece

of kidney tissue [slide]. The purple doughnuts, which of course is just a descriptive name, are kidney structures which are still in good condition, but these orange areas show the same structures which have deteriorated as a result of the poisoning effect of overdoses of the drug sulfamerazine.

Part of our work, as I said before, is directed toward attempting to do a better job of stocking fish at the proper times and the proper locations. At one of our research stations out in California, in the Sierra Nevada country [slide], these structures give us the opportunity to vary the flow in a test stream with a controlled stream right next to it. We have been able to work out for the use of our hatcheries a number of guidelines which permit planning our stocking programs in a more effective manner.

As you are well aware, the greatly increased use of pesticides and insecticides has caused a lot of problems for wildlife and for fish [slide]. We do not have a big program, but we have been running some work on the Yellowstone River in Montana since a spraying by the Forest Service for spruce budworm disease decimated the trout population in the Yellowstone River in 1955. Our work out there consists mainly in attempting to give advice to the Forest Service to prevent recurrences of the extreme mortality which did occur and also to determine, if we can, what the long-range effects of these applications of DDT are. We have found, for example, that trout after the actual application have up to 14½ parts per million of DDT in their body tissues several months. We are unable to say what ultimate effect this might have on humans which eat those DDT-loaded trout. We all know we are getting DDT in our systems all the time, in milk, vegetables, and so forth, but here is a problem that may have far-reaching complications.

Some of our work is on a demonstration basis. This biologist developed a shocking mechanism which is useful in collecting specimens of fish for study in back areas and is here demonstrating that to a group of State biologists from eight States in the Southeast, to inform them as to some of the latest developments in this field [slide].

One of our big needs in research is in connection with our warm-water operations. As I said earlier, warm-water fish culture is largely an extensive type of propagation. We need to refine our methods a great deal—to intensify our production—if we are going to meet the needs of the future. In many cases we think we have made progress in our own hatcheries, but we need to learn how to do a better job of warm-water fish propagation.

To turn to our management responsibilities, it is important that we recognize the very grave effects of planting fish indiscriminately without any regard to the biological factors which affect the survival of the fish.

This scene [slide], which is at our Hagerman Hatchery in Idaho and shows the loading of one of our tank-truck units, is thrown on here merely to illustrate the fact that unless we do pay proper attention to developing biologically sound stocking programs for our fish, it is just like pouring them down into the lower Potomac or some place which is badly polluted and where the fish could not survive.

We must be sure that we are making the best possible use from this very large hatchery effort. Unless we do so, we have fallen down in

21168—58——18

our responsibilities. This job of attempting to guide the activities of our hatcheries in the stocking phase of the work is one of the responsibilities of our fishery management services branch.

It is a most important responsibility in the long run, as I have said before, for unless we put those fish in the right water at the right time at the right size, they are not going to grow or they will not survive for the angler to catch them.

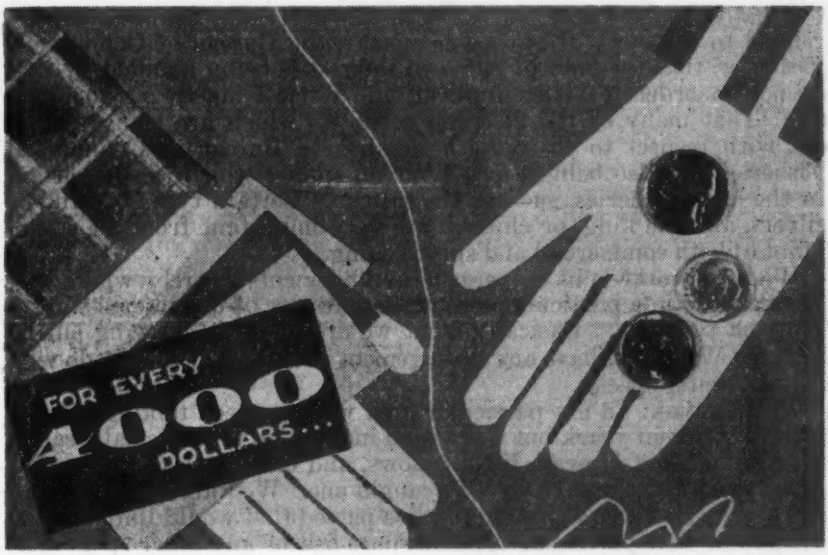
Many times even with the best of consideration of all the factors, survival is less than 50 percent. We are shooting for 100 percent, but we are a long way from it in most of our stocking progams. Management can be the key to reaching near that 100.

Management also consists of other things. As I said, it is the application of research findings. It has been found, for example, that many times it is more advantageous to eliminate a fish population entirely and start over, rather than just pouring endless numbers of game fish into the same water year after year with very little actual effect because of the competition from fish which are already growing and living there in large sizes.

Down in Tennessee last year there was a big cooperative management venture, in which the State of Tennessee, the Park Service and our outfit, and even the Air Force as you will notice from this helicopter [slide], cooperated. The ALCOA was getting ready to close the gates of the Chilhowee Dam, a new dam located on the outskirts of the Great Smoky National Park. They were able to close the river off up above and at that time this group of management men went in, poisoned the whole river, and eliminated all the carp and the suckers, and the various other trash fish which were present there. When the lake was filled the poison was dissipated. Our hatcheries and the State hatcheries from both North Carolina and Tennessee cooperated and went into a big trout stocking program. We are confident that this operation, which cost well over $50,000, will eliminate many times that cost in subsequent management activities.

In other words, we will produce good fishing more cheaply through this type of an operation than through many of our routine types of management that we would try later on. This is a technique which has been used widely all over the country.

I realize that we are not here talking about funds, but program, but I nevertheless cannot resist bringing out the fact that for every $4,000 which the American angler spends each year in participation in the sport of fishing, we are spending only 16 cents in our management and research efforts in the Federal Government.



For every $4,000 spent by America's anglers, the Federal Government spends 16 cents for sport fishery research and management.

We like to think, as I said, that hatcheries are guided in their operations by research and management, and I might say that there is some relationship between the size of the three programs as shown by this little cartoon [slide]. Hatcheries are a big thing in the Federal Government and our research and management efforts are not as extensive as they might be.

We like to think that our operation is one which goes along on a teamwork basis recognizing that research points the way, and through management and hatcheries, we could do a better job of producing better fishing.

Thank you very much and I would be glad to answer any questions.

Mr. LENNON. Are there any Federal statutes which control the size and the take of fish on the coastal waters in the ocean?

Mr. GOTTSCHALK. No, sir.

Mr. LENNON. In other words, what does your department do to stimulate salt-water fishing on the coastal areas which you say now, apparently, exceed that of all inland areas?

Mr. GOTTSCHALK. First, let me correct an impression.

There are actually about 4½ million salt-water anglers as compared with 16½ million anglers in other areas, so actually there are many more people still fishing inland than on the coastal areas, but fishing in those coastal waters has grown tremendously.

What are we doing? Our work in this particular field is so closely related to the work of our sister agency, the Bureau of Commercial Fisheries, that the bulk of our own interest is being handled by that agency in order to avoid duplication. What I am trying to say is this: That many of the research activities which are being carried out with respect to coastal fisheries by the Bureau of Commercial Fisheries are also being carried out on species which are important in the sport fisheries, such as the salmon. Certain types of salmon, silvers, and the king, or chinook are very important from the standpoint of both commercial and sport fishing.

We have worked out cooperative arrangements whereby where they are working in a particular area, they take care of our interests in the research program. Basically what we are doing is carrying out research. We do not have any management programs having to do with the salt-water species.

Mr. LENNON. In my particular area we have been talking a lot of sailfish in recent years, but there is an inclination to take small "sails." You know what I mean, little fellows, and other types of game fish of very small size, just to say "We caught one. We want to mount one."

There is no Federal statute that we passed that would limit the size of take of that particular type of sport fish or any other sport fish?

Mr. GOTTSCHALK. It has been considered for as long as I know anything about it that that is a State responsibility, sir.

Mr. LENNON. The State says it is a Federal responsibility. It has no control of navigable waters 5, 6, 7, and 8 miles off the coast.

Mr. GOTSCHALK. When you get out in the way-offshore areas——

Mr. LENNON. Five to seven miles is where they are caught.

Mr. GOTTSCHALK. Within the territorial limits our legal people tell us the States are responsible for that work, but in the offshore areas the Federal Government has worked with the other nations to establish size limits.

Mr. LENNON. You mean out beyond the 3-mile limit?

Mr. GOTTSCHALK. That is right.

Mr. LENNON. So that then it is a question that the United States would have to negotiate a treaty with England to determine the size of the catch of a fish 5 miles off the shore of North Carolina?

Mr. GOTTSCHALK. Perhaps that is stretching the point to make a point.

Mr. LENNON. That is what it amounts to, doesn't it?

Mr. GOTTSCHALK. Theoretically that could be the case. Actually we have gotten into a treaty arrangement. We do have the northwest Atlantic fishery group which has developed regulations for the haddock, for example.

Mr. LENNON. Does your department tell the commercial fisherman the type and kind and size of fish that he can catch on the coastal waters of the Atlantic coast beyond the 3-mile limit?

Mr. GOTTSCHALK. I would have to say no as a flat categorical answer.

Mr. LENNON. Who does tell them?

Mr. GOTTSCHALK. The reason I started to say it in just exactly that way is this: That they will consult with our Bureau and of course through the Commissioner of the Fish and Wildlife Service the interests of the sport fisherman would be considered to the extent that

we are empowered to take any management steps with respect to the sport fisheries in any given area.

Mr. LENNON. Even beyond the 3-mile limit?

Mr. GOTTSCHALK. Right.

Mr. LENNON. And do you do that?

Mr. GOTTSCHALK. Yes; we try to work very closely together.

Mr. LENNON. Sport fishermen complain about the commercial fishermen taking the species of the sport fish beyond the 3-mile limit and apparently nothing has been done about it.

Mr. GOTTSCHALK. Yes, sir; there is a great deal of apprehension among many sport fishermen, and commercial fishermen, too, I might add.

Mr. VAN PELT. Mr. Gottschalk, would you comment on what is being done on the Great Lakes, particularly Lake Superior and Lake Michigan, as to the progress we are making with the lamprey eel?

The CHAIRMAN. We had that subject on the slides.

Mr. VAN PELT. Oh, you did?

The CHAIRMAN. Yes.

Mr. VAN PELT. I am sorry.

The CHAIRMAN. It was on the lamprey eel in the lakes and was during these hearings. It is in the record, Mr. Van Pelt.

Mr. VAN PELT. I can get it from the record.

The CHAIRMAN. They have done extensive work and some new developments.

Mr. YOUNG. Mr. Chairman, I would like to compliment Mr. Gottschalk on an able and interesting presentation, and I would like to ask this last question.

I believe you showed on your slides that of all the salt water sport activity, about three-fourths of it is on the Atlantic and gulf coasts, the eastern shore and gulf?

Mr. GOTTSCHALK. That is correct.

Mr. YOUNG. Do you have any figures that would indicate what portion of that is in the gulf?

Mr. GOTTSCHALK. I wish I were able to answer that question, but unfortunately our survey was not broken down to that extent so we do not have any specific figures on that point.

Mr. YOUNG. Thank you, sir.

Mr. ALLEN. Mr. Chairman.

The CHAIRMAN. Mr. Allen.

Mr. ALLEN. Mr. Gottschalk, would you comment on the effect of the reorganization, as to whether the organization in the Department and the separation of the Bureau of Commercial Fisheries has had a good or bad influence on the handling of the sport fisheries and wildlife program?

Mr. GOTTSCHALK. Sir, it might be said that I am biased, because if it weren't for the fact that we were reorganized I wouldn't be here in this position, so obviously I feel that it has had a most salutary effect. To be perfectly serious about it, I think this reorganization act has given recognition to sport fisheries which they have needed for a long time and I think that in the long run it is definitely going to prove to have been a wonderful boost for the anglers of America.

I have been on the job only 2 months and I have a lot to learn and a lot to do, but I think it will provide a means by which we can do a

better job of coordinating our three main activities, hatcheries, research, and management.

I think also that it will provide added recognition among the anglers of the interest which the Congress and the Federal Government generally has in this field of fishing recreation. We have not begun to solve some of the administrative problems which undoubtedly will develop in connection with the commercial fishermen, but I think we have a mechanism. We have a closeness through the Commissioner's office and our Assistant Secretary whereby we will be able to coordinate programs which might appear to be places where we might get into overlapping. I am confident that in the long run we will find that this has been a great thing for the American angler.

Mr. ALLEN. Can you see any evidences where the improvement of the stature of the sport fisheries end of the activity has taken away from the wildlife activity?

Mr. GOTTSCHALK. My own opinion is that it hasn't. I think again it has enabled the Fish and Wildlife Service administratively to focus more attention on its wildlife problems. All of the wildlife activities are now grouped in a Division of Wildlife and it will be possible to, I believe, coordinate and stimulate those activities in the same way that I believe our sport fishery work will be stimulated.

Personally, I do not believe, for the reasons which I brought out right at the beginning of my talk, that our sport fisheries work will ever occupy the same position in the Federal Government that our migratory waterfowl work does. We have such a specific waterfowl management responsibility. If something goes wrong with the ducks no State is to blame; the Federal Government is to blame. In the sport fisheries we work hand in hand with the 48 States and we are all involved in the sport fisheries activities, so you can say the responsibility is spread over a wider area.

Mr. ALLEN. Thank you.

Mr. LENNON. Mr. Chairman, one more question.

The CHAIRMAN. Yes, sir.

Mr. LENNON. I am wondering, sir, in your Bureau of Sports Fisheries and Wildlife whether consideration has ever been given to the habitat and movement of certain types of game fish along the Atlantic coast and the Pacific coast in order that the fisherman of America might be alerted to those areas where these fish move in certain seasons. In the last 5 years we have discovered the sailfish off the North Carolina coast in great quantities—it must have been there before but we hadn't found it—as well as other species.

I just wondered if in your Department there is any consideration being given to a study of the movement of sport fish up and down the several coasts in order that through sport magazines and other periodicals which sportsmen avidly read they can find out something about the movement of these new species of sport fish that are moving in places that up until a few years ago they were never known to go.

We are catching tarpon off the coast of North Carolina. We just ran into them the last 2 or 3 years. Evidently it has been there before, but we had to find it by just going out there and looking for it. We are just wondering if some study of that nature couldn't be made, because the average sport fisherman will follow fish from

the tip of the Florida Keys all the way to Maine and all the way to Canada, in season and out of season, if he gets a lead as to where those fish might be.

I think it would be a tremendous help to the coastline, the Pacific and eastern coast, if your Department could initiate some study to try to advise the general public as to the movement of certain species of sport fish.

Mr. GOTTSCHALK. We certainly agree with you, sir. As a matter of fact, we have carried out work of that type in the past and are currently doing some of it, but there are many, many species, as you know, and it necessitates an effort for each particular one. That is, you can't assume that because the striped bass goes some place that the bluefish is going to go the same place. You have to run a tagging program on each species.

We have accumulated a lot of information on the spotted weakfish—the sea trout—and its migration and its movement up and down the coast is well known. A fish that we are working on at the present time is the striped bass. We have determined that most of the bass which are caught to the northward are Chesapeake Bay fish. But the thing that we are now getting into is the fact that they spawn in different streams in the Chesapeake Bay. If there should be excessive fishing in one of those streams at a particular time of the year we might lose a fairly important segment of the adult population way off at Montauk Point or some far away place.

The point I am making is that we have done some of that work and feel that it is extremely important that we carry it out for a larger number. There are some 40 species which range up and down the Atlantic, about which very little is actually known, except what people like yourself or the anglers have found out.

There is one thing I would like to make an observation about, however, and that is that maybe the sailfish and the tarpon weren't here before. There is very definite evidence of a warming trend in the oceans, both the Atlantic and Pacific, and it is quite possible that those fish have only just pushed their northern limits northward with this warming of the ocean in the last few years. They probably weren't there 10 years ago. It is a good possibility.

Mr. LENNON. We are catching them on my part of the Carolina coast in great quantities.

The CHAIRMAN. Mr. Zincke wants to ask a question.

Mr. ZINCKE. I would like to recall two slides to you, Mr. Gottschalk. One had to do with the number of pounds of fish hatched per hundred dollars of expenditure. In 1946, you stated, there were 90 pounds per hundred dollars and presently it is 130 pounds per hundred dollars.

Mr. GOTTSCHALK. Yes.

Mr. ZINCKE. Shortly thereafter you showed another slide with graphs which showed appropriations against production and on the second slide it showed that production had increased from six-tenths of a million pounds to 1.8 million.

Mr. GOTTSCHALK. Yes, sir.

Mr. ZINCKE. It showed that appropriations had increased from $1 million to $3.1 million.

Mr. GOTTSCHALK. Yes.

Mr. ZINCKE. In the first place, are those two slides comparable?

Mr. GOTTSCHALK. To this extent: That both of them are accurate. I noticed exactly the same point, so I took the trouble to check with our hatcheries personnel to find out exactly why there was an apparent discrepancy and the reason for that is this:

We have an overall hatchery budget and that was the figure that you saw on the screen. Now, by the nature of things, we are called on to do all sorts of things out of this hatchery appropriation. We have capital improvements. We have strictly routine maintenance costs and then we have other things that we are called on to do from time to time. We have to set up an exhibit at a fair and we run a little aquarium down at Welaka, Fla., and this, that and the other thing. We have one over in the Commerce Building.

In any event, the cost per pound is based on that portion of the total operating cost of the hatcheries which is directly attributable to the production of fish and that is 45 percent of the total appropriation as of October 1956 when these figures were put together.

Mr. ZINCKE. How was it as of 1946?

Mr. GOTTSCHALK. I can't give you that. I assume that they were parallel.

Mr. ZINCKE. I am just trying to relate these various figures.

Mr. GOTTSCHALK. Yes; I can appreciate what you are interested in. I merely got the 1956 figures. I didn't go back to 1946. I don't know whether it would be possible, to be perfectly frank.

Mr. ZINCKE. My point is that on your first slide you showed a reduction in cost per pound in very round figures, of 50 percent.

Mr. GOTTSCHALK. May I have just a moment?

Mr. ZINCKE. You can supply this for the record as far as I am concerned. I want to know the relationship between those various figures.

Mr. GOTTSCHALK. Between 1946 and 1956?

The CHAIRMAN. Will you supply that for the record and we will include it in the record.

(The information requested is as follows:)

ANALYSIS OF FISH-REARING COSTS IN FISH HATCHERIES

One measure of fish-hatchery efficiency is the cost of producing a pound of fish. In order to determine relative efficiency of various hatcheries or hatchery systems, figures must be comparable, and it is customary to use only the costs directly related to the hatching and feeding of fish in the hatcheries. Costs such as those for maintenance, capital improvements, general administration, and miscellaneous operations are not included in direct production cost figures.

In 1946, the production of fish from Federal hatcheries amounted to 630,000 pounds reared at a direct production cost of $692,720. This amounted to 56 percent of the funds appropriated for use at the various hatcheries. Production efficiency was thus $1.10 per pound, or approximately 90 pounds of fish produced for each $100 expended.

In 1956, the direct production costs were $1,399,950—45 percent of the funds appropriated for hatchery use. Production had increased to 1,852,000 pounds, and production efficiency was $0.76 per pound, or 130 pounds per $100 spent.

Mr. LENNON. I think you said that the coastal fishermen represented about a fourth of the total number of sport fishermen.

Mr. GOTTSCHALK. 4½ million out of 21 million, to be precise.

Mr. LENNON. What percentage of your total budget for sport fisheries is spent to encourage coastal fishing or doing something for the coastal fishing?

If all of your 96 or 98 hatcheries are for fresh-water fish—and that is where most of your budget goes, I assume—what percentage of your budget is spent to do something for these approximately 25 percent of our coastal sports fishermen?

Mr. GOTTSCHALK. As far as the immediate budget of the Sport Fisheries Division of the Bureau of Sports Fisheries and Wildlife, it is actually less than 1 percent.

Mr. LENNON. For coastal purposes?

Mr. GOTTSCHALK. That is right, but I think you would have to take into consideration the expenditures made by the Bureau of Commercial Fisheries for fish which are both commercial and sport, and I cannot furnish you that figure. I think there again we could supply it for the record if you desire. This happens to be so far outside of my responsibility that I do not know those figures offhand.

(The information requested is as follows:)

Appropriation for research programs of the Bureau of Commercial Fisheries on marine fish of importance in sport fishing, fiscal year 1958

Research on specific fishes:	
Shad fisheries of the Atlantic coast	$80,000
Striped bass fisheries of the Atlantic coast	60,000
Research of general significance:	
Offshore fisheries of the South Atlantic	85,000
Oceanography of the North Atlantic	40,000
Oceanography of the South Pacific	40,000

Mr. LENNON. That is the reason I say that I think, if 1 percent is being spent, that you can justify a study to determine the habitat and the movement of sport fisheries up and down the Atlantic and the Pacific coasts as well as the gulf coast.

Mr. GOTTSCHALK. We have certainly recognized a great need in this area and we are hopeful that ultimately we will be able to get a program going that will be somewhat in balance with respect to the needs.

Mr. LENNON. We hope so.

The CHAIRMAN. Thank you. I appreciate very much your coming down before the committee.

I want to ask Mr. Janzen one question. Is he present?

Mr. Janzen, come up here a minute, please.

In connection with the reproduction of migratory waterfowl, some years ago private sportsmen initiated program of incubation. In view of the depletion of birds that you pictured and the lack of breeding grounds, are you studying any substitute for that in the way of hatching? Do I make myself clear?

Mr. JANZEN. Yes, sir.

The CHAIRMAN. I just merely ask is such a program as that being carried on in Canada geese in these breeding areas?

Mr. JANZEN. We are carrying on some studies now especially in connection with Canada geese because we have found that they are susceptible to intensive management. They apparently will survive very well in civilization with proper protection, so we are working on, you might say, artificial production on our wildlife refuges. For example, on our lower Souris refuge, where we have quite a number of Canada geese, we have been robbing the nest so they continue to lay.

The CHAIRMAN. You incubate the eggs?

Mr. JANZEN. Yes.

The CHAIRMAN. Are migratory ducks similar to domestic ducks? They drop an egg here and there and don't have any regular place as a rule?

Mr. JANZEN. Migratory birds usually lay their eggs in nests. You mean——

The CHAIRMAN. Similar to domestic ducks. They will lay eggs here and eggs there and around. I was wondering whether you are carrying on any incubation or carrying on anything with migratory ducks.

Mr. JANZEN. Your wild ducks do not. They pick out a nest, lay a certain number of eggs, and hatch them out.

The CHAIRMAN. Where do these private sportsmen get their eggs they hatch out? I remember Mr. Corey and Mr. Natch used to hatch thousands of ducks down in Currituck Sound. Where did they get them?

Mr. JANZEN. Probably these were mallards or black ducks.

The CHAIRMAN. No, they got them from Canada. They were wild ducks.

Mr. JANZEN. We have been doing some robbing of nests. If you can rob the nest the birds will continue to lay eggs in the nest and a bird will lay quite a number of eggs over its natural allotment.

The CHAIRMAN. The reason I ask that question is you depicted the vanishing of this hatching area, so I was just wondering if that angle had been explored for a possible solution.

Mr. JANZEN. Yes. The State of Wisconsin has been carrying on some rather large-scale experiments. In fact, they financed a club, which were raising around 8,000 or 9,000 ducklings a year but those mallard ducks which were produced, and they grew to the adult stage, never did quite revert to the wild in that particular area as the hunters preferred. Almost all the birds were killed in the immediate vicinity, but I think there is a field there and I think it has just been touched.

The CHAIRMAN. These ducks that I knew of went back north with the migration. That is the reason I asked the question.

Mr. JANZEN. Do you know what species now we are talking about?

The CHAIRMAN. Pintails, mallards, and so forth.

Mr. JANZEN. There has been some experimental work done on that, yes.

The CHAIRMAN. That has been a long time ago. These men that I referred to have passed on, and nobody does it down there. They were very wealthy men, and they spent a lot of money doing that. The Secretary nodded. I wonder if he could comment.

Mr. Ross G. LEFFLER (Assistant Secretary of the Department of the Interior for Fisheries and Wildlife). I would just like to add a little bit on that, if that is agreeable, because it is one that I have been personally very much interested in for some time.

Many of the States are carrying on propagating programs and releasing ducks on their various waters which do migrate to the south or to the north, whichever it may be. Personally, I carried on some in a very small way in a pond of mine and they, believe me, have regularly gone south in the fall. They don't go north, and some of them stop on the way back up for feed for 2 or 3 months from my supply of food and they are very helpful, also, in fertilizing some of the eggs in the area, but I can say to you that the artificial propagation of ducks

is being carried on by the States and by many breeders throughout the country.

The CHAIRMAN. What contribution, then, is the Fish and Wildlife Service making?

Mr. LEFFLER. We give them a certain amount of technical knowledge,, but, generally, the private breeders carry it on at their own expense and the States do the same.

The CHAIRMAN. Thank you very much.

This concludes the hearings with the Fish and Wildlife Service, and we thank you, Mr. Secretary, and your entire staff, for the interesting hearings we have had.

(Whereupon, at 12:15 p. m. the committee was recessed, to reconvene at 10 a. m., Thursday, January 16, 1958.)

APPENDIX

RESEARCH AND ACTIVITIES UNDER THE SALTONSTALL-KENNEDY ACT, FISCAL YEAR 1957

DEPARTMENT OF THE INTERIOR,
OFFICE OF THE SECRETARY,
Washington, D. C., January 15, 1958.

Hon. RICHARD M. NIXON,
President of the Senate,
Washington, D. C.

DEAR MR. PRESIDENT: There is transmitted herewith, for reference to the appropriate Senate committee, the third annual report of activities and research conducted by or under contract with the Fish and Wildlife Service of the Department of the Interior to encourage the distribution of domestically produced fishery products.

This report for the fiscal year ending June 30, 1957, is submitted pursuant to the provisions of the act of July 1, 1954 (68 Stat. 376), as amended by the Fish and Wildlife Act of 1956 (70 Stat. 119), and covers in detail the use of the separate fund created by the referenced statutes.

Sincerely yours,

FRED A. SEATON,
Secretary of the Interior.

DEPARTMENT OF THE INTERIOR,
OFFICE OF THE SECRETARY,
Washington, D. C., January 15, 1958.

Hon. SAM RAYBURN,
Speaker of the House of Representatives,
Washington, D. C.

DEAR MR. SPEAKER: There is transmitted herewith, for reference to the appropriate House committee, the third annual report of activities and research conducted by or under contract with the Fish and Wildlife Service of the Department of the Interior to encourage the distribution of domestically produced fishery products.

This report for the fiscal year ending June 30, 1957, is submitted pursuant to the provisions of the act of July 1, 1954 (68 Stat. 376), as amended by the Fish and Wildlife Act of 1956 (70 Stat. 119), and covers in detail the use of the separate fund created by the referenced statutes.

Sincerely yours,

FRED A. SEATON,
Secretary of the Interior.

DEPARTMENT OF THE INTERIOR,
FISH AND WILDLIFE SERVICE,
BUREAU OF COMMERCIAL FISHERIES,
Washington, D. C., December 26, 1957.

To: Secretary of the Interior.
Through: Assistant Secretary for Fish and Wildlife.
From: Commissioner.
Subject: Annual report under the Saltonstall-Kennedy Act.

The act of July 1, 1954 (68 Stat. 376), commonly known as the Saltonstall-Kennedy Act, as amended by the Fish and Wildlife Act of 1956 (70 Stat. 119), made available to the Department of the Interior for each fiscal year beginning with the fiscal year commencing July 1, 1954, 30 percent of the gross receipts from duties collected under the customs laws on fishery products "* * * to

promote the free flow of domestically produced fishery products in commerce * * *" The act further provided for a report "* * * to the appropriate committees of Congress annually on the use of the separate fund created * * *"

Submitted herewith is the report of the work of the Fish and Wildlife Service for the fiscal year ended June 30, 1957.

ARNIE J. SUOMELA.

PROGRESS IN FISHERY BIOLOGICAL STUDIES

COASTAL AND OFFSHORE FISHERY RESEARCH

Salmon and Related Species

On the basis of preliminary data the products of Alaska commercial fisheries in 1956 were valued at about $110 million. Of this, canned salmon was valued at $86 million; troll salmon, $4 million; halibut, $6 million; herring, $2,400,000; crab, $2,200,000; and the balance, salmon used by local peoples, and other species. The value of the canned product comprises nearly 25 percent of the value of canned fish in the United States, and the total fish production of the Territory equals about 10 percent of the total fish production of the United States.

The fish are by far the most valuable product of Alaska. During 1956, when fish brought $110 million, forest products were valued at $34 million and minerals at $25 million. Of the latter, sand and gravel were worth $16 million.

The Bureau of Commercial Fisheries has the responsibility, clearly assigned under the White Act, to manage the fisheries resources in a manner that will provide for the maximum sustained yield. The Bureau has three primary functions: (1) To investigate the status of the fisheries resources and determine by scientific means whether they are yielding the maximum harvest, and, if they are not, how this might be done; (2) to translate the scientific findings into management measures and regulations in order to achieve the maximum sustained yield; and (3) to enforce the fishery laws and regulations which apply in Alaskan waters.

The major problem is the restoration of the salmon. The salmon fisheries of Alaska maintained a sustained yield of 5 million to 6 million cases during the 1920's and 1930's. Since 1941, they have steadily declined to a low of 2,300,000 cases in 1955. This has happened with no significant deforestation, pollution, damming of the rivers, or high-seas fishing during most of this decline.

It must be concluded that fishing itself is one of the primary causes of this decline. We estimate that, if fishing were unrestricted in Alaska today, more than 90 percent of all of the runs would be caught. We can conclusively demonstrate on certain fisheries that, during the open-fishing periods, less than 5 percent of the runs escape.

The problem, however, is not simply one of allowing an adequate total amount of escapement, because some streams have continued to decline with more than 50-percent escapement. Instead, the remarkable homing instinct of the salmon requires that some of each species of each run to every part of every river system must escape if the available spawning areas are to be seeded adequately. In addition, the escapement must occur at a time when the eggs find the best temperatures and water supplies for their survival. We seek, therefore, to improve the quality of escapement—escapement from the early, middle, and late portions of every run, and not just the early runs or the latecomers.

With Alaska's other important fisheries, the problems vary greatly. The herring resource is a major one, and biologists generally agree that a greater proportion of the herring could be harvested. However, many salmon trollers of Alaska feel that the herring is indispensable to the stocks of king and coho salmon. Information must be found to resolve these differences. The king-crab fishery is rapidly developing into a fishery of major importance in the Kodiak and Alaska Peninsula areas. How much can it develop without endangering the stocks?

With the shrimp, clam, bottom fish, sea scallop, and other potential fisheries of Alaska, the problems are those of development. They are urgent problems, because in many cases the addition of other fisheries would provide a far more stable economy than the 1- or 2-month salmon fishery. The management of these resources requires information to minimize the risk of the entrepreneur and to stabilize the developing fisheries.

Our greatly expanded research effort of the last 2 years is being directed at a solution of these major problems:

(1) *Predictions.*—Our management can be no better than our predictions, because regulations must be stated months in advance and must anticipate the

size of the returning runs. If large, the regulations can be liberalized; if small, then the runs must have further protection. We are undertaking these predictions for salmon by trying to determine the abundance of the fry or fingerling salmon as they move out to sea and after the young have encountered the principal causes of mortality during their life history. The abundance of herring in the summer fishery is being predicted by aerial surveys of spring spawning.

(2) *Migrations.*—Many of the salmon runs go through a gantlet of fishing gear for weeks before approaching the home stream. Others, and especially the large red salmon runs that ascend rivers on exposed coasts, may enter the river directly from the ocean, and can be taken only by gear in the mouth of the river. The migration route, the timing, and the speed of movement of each run of salmon must be known to the management man who devises regulations for its utilization.

(3) *Identity of stocks.*—Many of the salmon runs mix with others in certain fisheries. It is essential to know where the runs are mixed and where the stocks are separate, primarily in order to know how much of each stock is being taken. Similar problems exist with the herring stocks.

(4) *Management techniques.*—Methods of counting escaping adults are being investigated, stream catalogs are being prepared, the value and techniques of predator controls are under study.

(5) *Survival in fresh water.*—In these studies on salmon, we seek the key to understanding the causes of the great mortality of eggs and fry. Being studied are the effects of weather, freshets, the physical, chemical, and biological requirements of the young during the fresh-water life, and basic productivity of salmon lakes and means of improving it.

(6) *Effects of industry.*—Almost no changes have taken place in salmon streams, but logging is starting. In active cooperation with the Forest Service, we are making a direct study of the effects of logging in southeastern Alaska on the pink-salmon streams.

The program is organized under 5 major and 2 minor investigations. There are 4 salmon investigations, 3 of them regionalized in southeastern, central, and western Alaska, and the fourth is the salmon-survival investigations, embracing work at the field stations, Little Port Walter, Karluk Lake, and Brooks Lake. The fifth major investigation is in marine fisheries, and comprises 2 sections—1 on herring and 1 on shellfish. The two minor investigations are special studies of biometrics problems and an analysis of past data on Alaskan fisheries.

About one-third by number and value of the projects has been contracted with universities and the Alaska Department of Fish and Game. A number of the contracts are with the Fisheries Research Institute of the University of Washington; 2 are with the School of Fisheries of the University of Washington; and 1 major contract on king crab is with the Allan Hancock Foundation of the University of Southern California. Two contracts are currently in effect with the Alaska Department of Fish and Game.

During fiscal year 1957, 17 percent of the funds available were regular appropriations. Most of these funds have gone to continue the work at the field stations at Little Port Walter, Brooks Lake, and Karluk Lake on the survival of salmon in fresh water. The balance of the funds obtained under the Saltonstall-Kennedy Act has been directed to the most immediate problems of management, such as prediction, migration, identity of stocks, and management techniques.

All of the substantial research problems are on a project basis. Almost all of the projects involve an annual cycle of field and laboratory work. Prior to the field season, a thorough plan of the entire project is prepare by the project leader. This is followed at the end of the field season by a field report which embodies an account of the observations made in the field and the results of any field analysis. Subsequently, research reports are prepared for publication or for administrative use.

Other agencies performing research on Alaskan fisheries are the Alaska Department of Fish and Game, the Fisheries Research Institute of the University of Washington (with funds contributed by the salmon industry) and the North Pacific Salmon Investigations of the Bureau of Commercial Fisheries headquartered in Seattle. Cooperation with these other agencies is effected first, by circulation to each of them of all operations plans, and secondly, by conferences on all major investigations. Plans are under way for further coordination of the work through prompt publication of results. We intend to commence publication of Alaska fisheries briefs which will be a means of bringing very rapidly to the attention of people in the industry and other fishery organizations the immediate results of our work.

These reports have been arranged under the investigations as organized by the research section of the Administration of Alaska Commercial Fisheries. Included are both contract and force account work under Saltonstall-Kennedy funds and also the closely integrated research conducted under regular funds.

Southeastern Alaska Salmon Investigations

1. *Enumeration of pink and chum salmon fry.*—The principal objective of this program is to estimate the number of outmigrating pink salmon fry in southeastern Alaska south of Sumner Straits. Such estimates will be used to predict the size of returning runs. Techniques for trapping the fry were developed in 1956, and these were applied in the spring of 1957 to 16 streams in southeastern Alaska. The streams are carefully selected samples from which it is expected that estimates in the total migration may be obtained.

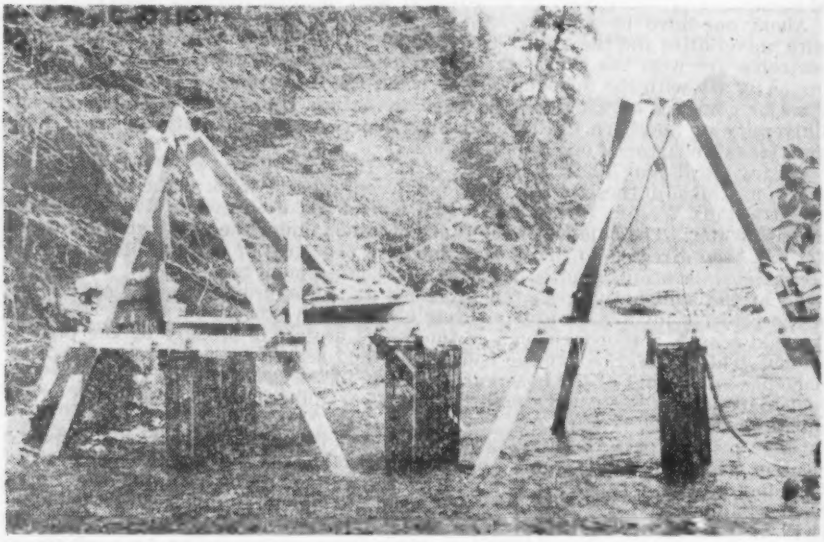
2. *Abundance of pink salmon fingerlings.*—This project is to continue and expand the census of pink salmon fingerlings in inland waters of southeastern Alaska. Index counts of the fingerlings have been obtained from trap watchmen since 1955. The index is to be continued, and tests of its reliability are to be started by trapping and trawling experiments in the concentrations of pink salmon fingerlings. This project will also provide a basis for predicting the size of the returning run. The results will be compared critically with estimates of fry production, and the best technique will be selected for routine use.

3. *Tagging off Prince of Wales Island.*—Contract with Fisheries Research Institute, University of Washington.

The primary objective is to determine the home stream and migratory routes of the red and pink salmon taken near the Alaska-Canada border. The work is being closely coordinated with similar tagging by Canadian biologists in British Columbia.

4. *Inventory of southeastern Alaska streams.*—Contract with Fisheries Research Institute, University of Washington.

This project is to bring together the voluminous and scattered data on the salmon streams of Alaska. The data include the results of physical and biological surveys for many years and are to be found in the files of the Fisheries Research Institute, the Fish and Wildlife Service and the Alaska Department of Fish and Game. It is planned to be a 1-year project.



Traps for sampling downstream migration of pink salmon fry in Prince William Sound stream.

5. *Effects of logging on salmon.*—Contract with Fisheries Research Institute, University of Washington.

One season's work has been completed on three test streams in the vicinity of logging operations at Hollis just west of Ketchikan. The 3 test streams include 1 that has been logged, 1 that is about to be logged and 1 that will not be logged. The objectives are to determine the complete physical and biological changes in the streams that are caused by the logging operations. The work is being conducted in very close cooperation with the Forest Research Center of the United States Forest Service and with other Fish and Wildlife Service operations in the area.

The first season's work provided counts of the escaping pink salmon, detailed charts of the spawning areas, estimates of the survival of eggs through the winter, estimates of the number of downstream migrating fry, estimates of the silt load of the streams, development of techniques for determining subsurface flow and oxygen content in the spawning beds themselves. The work is continuing.

Central Alaska Salmon Investigations

6. *Escapement of red salmon, Cook Inlet and Copper River.*—All of the major river systems of Cook Inlet and the Copper River are turbid glacial streams. The salmon runs to each of these rivers probably consist of many groups or subraces, each destined for a specific part of the river system spawning grounds. It is essential to have an escapement from each part of the run.

This project is to develop a technique of test-fishing at the head of tidewater in order to evaluate the day-by-day escapement through the fishery. Further, tagging experiments will attempt to determine the subraces of fish. Activities this year are being concentrated on the Kenai River in Cook Inlet.

7. *Tagging red and pink salmon in Cook Inlet and Prince William Sound.*—Contract with Fisheries Research Institute, University of Washington.

The delineation of the races of both of these species of salmon, their migratory routes and timing of the runs are essential to the management of these major fisheries. These tagging experiments will supplement the earlier scattered tagging experiments conducted in both areas by the Bureau of Commercial Fisheries.

8. *Studies of Alaska Peninsula pink salmon runs.*—The production of pink salmon from the peninsula has declined almost steadily for 20 years. The causes of the decline are unknown.

This project will commence with tagging experiments to determine the identity of the stocks of fish caught in the Shumagin Islands and the rate of movement of the fish along the coast during the August 2 to August 14 closed period. They will attempt to determine specifically whether this closed period is adequate to protect the stocks.

9. *Enumeration of pink salmon fry in Prince William Sound.*—This is to provide a basis for predicting the expected return of pink salmon.

The technique of trapping the fry as they move downstream in the early spring has been extended to Prince William Sound on the basis of experience in southeastern Alaska. In this first year's operation the sites for the trapping were selected, camps established and modified techniques developed suited to the short streams with a large amount of spawning in the intertidal zone.

10. *Abundance of pink salmon fingerlings in Prince William Sound.*—This is an attempt to determine the abundance of the fingerling salmon in the waters of the sound during the summer growing season as a basis for prediction. Commercial traps are two few to utilize counts by the trap watchmen, so special methods of trapping, seining and trawling are being investigated.

11. *Study of sea lions and hair seals in central and western Alaska.*—Contract with Fisheries Research Institute, University of Washington. The work of the first season has concentrated on development of aerial census techniques and an actual aerial census of the rookeries from Prince William Sound to Unimak Island and in Bristol Bay.

The aerial surveys have been made from a twin-engine amphibian plane flown at about 50 to 200 feet altitude around the rookeries. Serial pictures are taken of the complete coastline of each rookery and used to obtain counts of the animals.

Forty-five rookeries were surveyed in this manner in the summer of 1956. The surveys from July 21 to August 9 revealed a total of 59,995 sea lions and 7,615 hair seals on the 45 rookeries.

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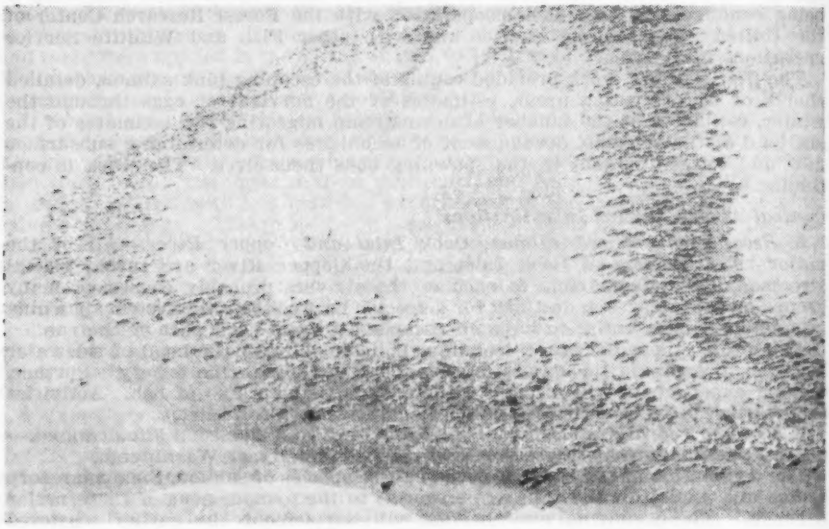
Additional surveys were made of part of the rookeries in September and December to determine seasonal movements. The September surveys showed about the same quantity of sea lions, but in December, only one-third of them could be located.

The surveys are being continued in 1957 and supplemented by studies of sea lions on the rookeries and stomach analysis of all sea lions that can be obtained during high seas fishing operations.



Two thousand four hundred hair seals in a single rookery.

Western Alaska salmon investigations

12. *Tagging red salmon in Bristol Bay.*—During the 1956 season, 6,903 red salmon were tagged by 4 tagging crews 1 each of which operated in each major fishing area. The objective of this tagging were to determine the migratory route of salmon bound for each of the river systems, the timing of the migration, and the length of time the fish are exposed to the fishery. It was found that the Nushagak stock was nearly separate whereas the fish bound for Naknek, Kvichak, Egegik and Ugashik mixed to a large extent in the fishing areas. Further, it was found that nearly all of the recoveries from the commercial fishery were made within 4 to 6 days after tagging.

With these answers in hand, the work in 1957 is being concentrated in the major Naknek-Kvichak fishery to determine more accurately the time of passage. The tagging will be supplemented by a special test-fishing in the upper limits of the fishery and closely coordinated wtih daily surveys of the distribution of the fishing fleet in order to plot the movement of the fish through the area.

13. *Evaluation of tower counting.*—This project was to test whether migrating adult red salmon can be counted from a tower or other observation point with sufficient accuracy to eliminate costly weirs. Careful studies were conducted on the Egegik River in Bristol Bay during the 1956 season where it was found that the counts made from towers were within 7 percent of the counts made from the weir. Most of this difference was due to lack of complete coverage from towers at certain critical periods during the run, and it was judged that with an improved technique nearly 100 percent accuracy could be effected.

On this basis, weirs in the Ugashik and Egegik Rivers have been eliminated in 1957. Counts of the escapement of red salmon will be made from towers. In addition, the escapement up the Alagnak River will be counted for the first time by use of towers. Further special studies will be made to compare counts from towers with counts from the weir in the Naknek River, the one remaining weir in the Bristol Bay area. These special studies were decided upon because the Naknek is one of the largest rivers in the area and is moderately turbid so that observations of the fish are quite difficult.

Special experiments also are being undertaken to determine whether electronic counting equipment can be used with a simple array of stakes near the towers.

If so, this promises an even cheaper and more accurate method of obtaining the counts.

14. *Enumeration of red salmon fingerlings.*—These studies concentrated on the Naknek River in 1956 and were to estimate the total downstream migration together with details of the behavior of the fingerlings.

The run in the Naknek was estimated to be 6 million smolts from May 29 through August 20. Most of the smolts moved down the river during darkness, but substantial numbers came down during daytime. They tended to move down quite consistently near the center of the river.

The Egegik River was also sampled, but very few migrants were taken during the season, and most of these very early, just as the ice was going out of the river. No estimate of the total number was obtained, but the catches will serve as an index.

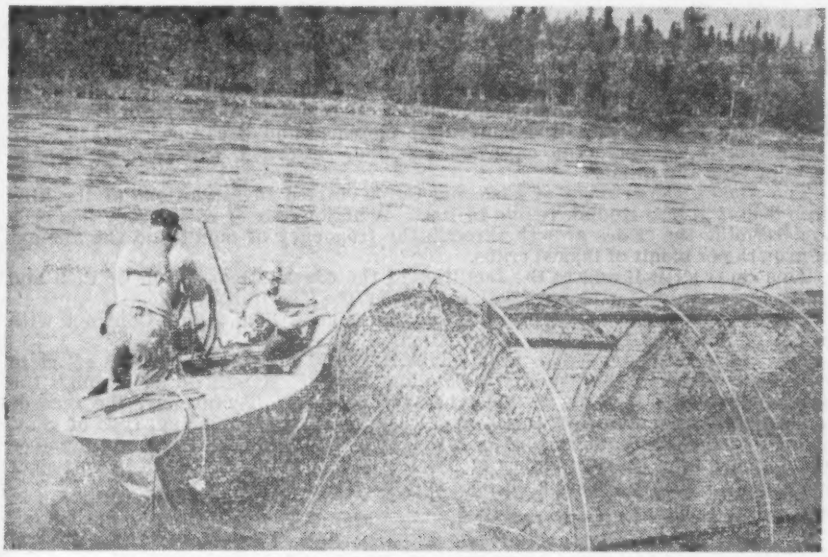
The pattern of migration with respect to time of day and time of season is quite different in Egegik, Naknek, Kvichak, and Nushagak Rivers. We concluded from the first year's operations that we need much more complete studies of the behavior and habits of the smolts before fully reliable estimates of their numbers may be obtained.

In 1957 improved nets and techniques are being used to sample the Naknek migration in a "Latin square" statistical pattern which is expected to provide a much more reliable estimate of the total migration in the Naknek. Sampling in the Egegik is being continued but is expected to provide only an index of the number of smolts moving down the stream.

15. *Studies of Kvichak salmon.*—Contract with Fisheries Research Institute, University of Washington.

This is a broad, basic, and continuous study of the largest red salmon run in Alaska. Data are being obtained annually of direct and immediate importance to management. These include the daily escapement of fish up the river (9,443,000 in 1956) where they are counted by means of towers and an index of the downstream migration of fingerlings in the spring when they are trapped by fyke nets. In addition, the adults in the catch and escapement are sampled to determine size and age composition and the spawning grounds are surveyed to determine the distribution of escapement.

16. *Reconnaissance of fisheries north of Bristol Bay.*—This project was begun in the 1957 season at the urgent request of the American section of the North Pacific Fisheries Commission in order to obtain data on the fisheries north of Bristol Bay in answer to requests of the Japanese Government. This will be a reconnaissance to determine the location and recent histories of the salmon runs and the proportion of them utilized by the native peoples.



Test net fishing to measure escapement in a turbid river.

Biometrics Investigations

17. *Sampling methods for Bristol Bay red salmon.*—The gill net used in Bristol Bay select larger fish which comprises a larger proportion of males. It has not been possible in the past to determine precisely the age and size composition of any run because fish varied in size and age depending on whether they were obtained in the fishery or on their way up the river or on the spawning grounds. A large amount of data has been accumulated, and this study is designed to determine its reliability, to develop improved methods of sampling and to determine precisely the selective action of the drift nets and set nets.

Marine fisheries investigations

Herring

18. *Aerial spawning surveys.*—These are aerial surveys of the beach spawning in the spring which provide an estimate of the abundance of fish prior to the start of the summer fishery. This year's work has been directed at developing improved techniques and minimum cost methods of aerial census and has further supplemented the aerial census by an actual sample of the eggs from the beaches in order to estimate the total egg deposition and the size of the spawning stock. The work is a continuation of work performed on a much more limited scale with management funds during the past 4 years.

19. *Age and abundance of summer herring.*—This is a project to continue and expand the sampling of the summer fishery that has been conducted for many years with management funds. The sampling has obtained the age and size composition of the herring in the catch. The age composition serves as a direct method of estimating the condition of the herring stocks.

The expanded project will attempt to improve and simplify the sampling techniques and will commence a study of the habits of the herring, particularly to determine the extent to which they provide food for salmon.

20. *Georgraphic limits of herring stocks.*—The major question to be answered by this project is the extent to which the herring stocks on Kodiak, Prince William Sound, Sitka, Craig, and Juneau in southeastern Alaska intermingle. Must they be managed separately, or are the same groups of herring caught in all of these fisheries?

Extensive tagging during the thirties has provided some answers to this, but tagging herring is extremely difficult, and the tagging did not furnish sufficient evidence of mingling. This study will commence with an attempt to distinguish stocks by differences in growth, to examine the possibility of serological differences, and to develop a radioactive tag which can be much more easily detected in the herring production plants.

Shellfish

21. *Studies of the king crab in Cook Inlet.*—Contract with the Allan Hancock Foundation, University of Southern California.

This is a new study of the king crab in the Cook Inlet area with initial objectives to determine migration and population intermingling, details of the moulting, growth, food, mating season, larval development and disease.

22. *Growth of king crab on Kodiak Island.*—Contract with Alaska Department of Fish and Game.

The Alaska Department of Fish and Game started investigations of the king crab fishery in the Kodiak region in 1954. A major part of their study has been to determine the crab's growth through the frequency of moult and the amount of growth per moult of tagged crabs.

This contract will add to the facilities of the Alaska Department of Fish and Game and provide for more effective work by the Territorial biologist.

23. *Study of king crab in Kodiak and the Alaska Peninsula.*—Contract with School of Fisheries, University of Washington.

This project is intended to provide the essential data on catch and effort in each area fished in this rapidly expanding fishery. It will do so through the development of a logbook system wherever possible. Tentatively, the records to be required are name of vessel, statistical area, date of fishing, type of gear, number of drags or pots, number and weight of marketable crab caught, number of undersize crab taken, number of females taken, number of crab in soft-shell condition, number of crab in process of moulting.

Salmon survival investigations

24. *Pink and chum salmon survival at Little Port Walter.*—With these funds the permanent field station at Little Port Walter is operated the year around.

It is located on Sashin Creek where records of the upstream migration of pink salmon and of downstream migration of fry have been maintained since 1941.

The added Saltonstall-Kennedy funds will permit expansion of the studies here to develop an experimental technique for determining the survival of pink salmon in the stream. It is expected that this will provide means of determining exactly the factors of temperature, water flow, silting, salinity and oxygen that may be responsible for mortality during the egg and larval periods.

25. *Red salmon studies in Karluk and Bare Lakes.*—This is a continuation of the work on Karluk Lake where many of the basic facts about red salmon in Alaska have been determined. Through this continuing program, the escapement has been determined along with the number of downstream migrating fingerlings. Special studies are being started this year of the red salmon themselves in the lake system. These studies will attempt to isolate each factor in the mortality during egg, larval, and fingerling stages and will permit evaluation of the effect of the planned rehabilitation program.

The Bare Lake studies commenced in 1950. They have comprised an experiment to determine whether twice annual fertilization would increase the basic productivity and in turn growth rate and survival of red salmon juveniles. Studies involve total counts of all salmon entering and leaving the lake, thorough chemical and plankton analyses throughout the summer season. The observations will be continued this year without fertilization in order to measure the changes in the lake.

27. *Kitoi Lake studies.*—Contract with the Alaska Department of Fish and Game.

This contract is to give assistance to a project being financed principally by the Alaska Department of Fish and Game. The study is to determine the growth and survival of red salmon fry in lakes with and without other fish populations. Two experimental lakes on Afognak Island have been used, both of which are inaccessible to salmon, and one of which has been poisoned to remove all fish life.

These lakes were stocked in 1956 with hatchery fry; the first seaward migrations occurred in 1957. It was found that the lake that had been poisoned and was free of other fish life had by far the best survival and growth of red salmon fingerlings.

28. *Red salmon survival at Brooks Lake.*—Brooks Lake is a tributary to the Naknek River system in Bristol Bay. Very broadly the study requires that all salmon entering and leaving the system be enumerated and all possible factors that may affect their survival measured.

One major part of the investigations will involve the use of radioactive tracers to determine the basic productivity of the lake and the effect on that productivity of various salts and vitamins. This technique is expected to provide a very rapid method of determining any basic deficiencies of rare earths which might be necessary for the production of salmon.

29. *Analysis of past data.*—Contract with the School of Fisheries, University of Washington. Also a contract for IBM analysis of sea temperature data is pending.

The fisheries investigations in Alaska over several decades have produced an enormous backlog of unanalyzed data. The data have all been inventoried, and these contracts are to commence analysis of particular parts. To be given special attention are analysis of extensive material on the Chignik red salmon fisheries and lakes and analysis of results of many years of salmon tagging in southeastern Alaska.

PACIFIC SALMON INVESTIGATION

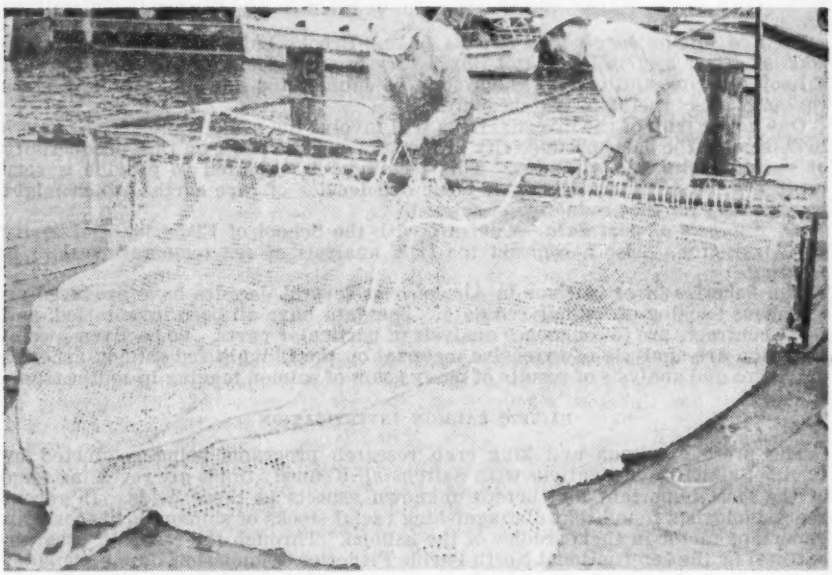
The present salmon and king crab research programs being conducted by Pacific Salmon Investigations with Saltonstall-Kennedy funds are revealing some of the most important and hereto unknown aspects in those fields. In recent years, biologists found that distinguishing racial stocks of salmon has become an important factor in their studies of the salmon. Through the research program outlined by the International North Pacific Fisheries Commission, Japan, Canada, and the United States have embarked on a program to explore the North Pacific Ocean and the Bering Sea from Asia to North America, to study completely the oceanography and distribution of salmon in this area.

Three chartered vessels, all halibut schooners, have departed from Seattle for the North Pacific Ocean. The vessels are fully equipped with oceanographic equipment, freezers, and gill nets for intensive research operations. They will cover an area extending from the 57° latitude in the Bering Sea southward to the 45° latitude, and from the 175° east longitude (east of Attu Island) to the

160° longitude (south from Shumagin Islands). Several stations between the Pribilof Islands and the Aleutian Islands have been fished, but the large concentrations of red salmon (*O. nerka*) as observed last year, were not present. However, one vessel fishing near the 175° east longitude caught larger numbers of red salmon. The vessel will follow the prescribed grid pattern to determine the movement of these fish toward Bristol Bay.

At each station, oceanographic data is taken, the gill net set (weather permitting) and the net is hauled aboard the next morning. All of the fishing is done at night. The oceanographic data includes bathythermographs, plankton samples, water samples for salinity, and weather data. The catch is sorted, tagged, measured, and a scale sample taken. Then the fish are frozen for later shipment to the Seattle Laboratory for examination by the morphological unit. By using six morphological characteristics (lateral line scales, total gill rakers, numbers of branchiostegals, pectoral and anal fin rays, and position of the first haemal arch), definite distinguishing characters in salmon taken in certain commercial fisheries can be shown. When these data are combined with scale readings, parasitological and serological data, the determining character of each race of salmon should become known. With such pronounced characteristics, a salmon caught on the high seas could be examined in the laboratory and the area from which it came as a fry or fingerling will be evident. This could mean that scientists will be able to determine the high seas "pasture" for a specific race of salmon and can take steps to manage that area.

Last year (summer of 1956) 19,000 salmon were collected from the high seas, commercial fisheries of Japan, Canada, Alaska, and the United States, and from the spawning grounds in some of these areas. As yet, samples have not been collected from the Kamchatka Peninsula coast or spawning grounds. Samples from this area would complete the entire program now under way. As of June 30, 1957, 8,000 salmon have been examined by the morphological unit. With the installation of walk-in freezers, the unit has increased the processing from 1,000 to 1,200 salmon per month. Samples are sent to Canada and Japan for analysis and examination, as well as being used by groups studying parasitology and osteology.



Beam trawl for Bering Sea king crab research.

Personnel are sent to key commercial fishery areas to collect samples from the respective fisheries. To insure adequate sampling of the important salmon stocks, the quota of salmon is being slightly increased this season. It is believed such a large sampling program will definitely yield results applicable to distinguishing races of salmon.

The king crab fishery of the Bering Sea is of great economic importance to the United States and Japan. The program this summer includes studies on the status of maturity, distribution, abundance and environment of the king crab. Also, water current determination studies, and a systematic sampling and tagging program over a grid pattern that extends beyond the present areas of commercial exploitation, are being conducted. To date, 300 crabs have been tagged, and this operation is just underway. Specimens of larval king crabs were collected during the first part of the operation, and were among hauls of adult crabs. In May there was a noticeable abundance of moulted female crabs present.

The king crab investigation chartered the *MV Mitkof* for this summer's operations. The vessel was equipped with otter trawls, beam trawls, live tanks, and oceanographic equipment for the research operations.

The research program being carried out by Pacific Salmon Investigations for the International North Pacific Fisheries Commission is a definite step toward better understanding of the heretofore unknown phases in the life histories of the salmon and king crab. The results of this research will enable the Commission to manage and regulate these important fisheries. The basic research and study on life histories, abundance, distribution, etc., is an absolute necessity in order to maintain proper control and utilization.

The scentific papers in the fisheries research field are increasing throughout the world. Some of these works are extremely valuable to American biologists. The Literature Research Unit has a Russian translator working on papers involving salmon and king crab research. Several Russian manuscripts are completed in English concerning the food habits and activities of king crabs in captivity. A rather lengthy and important document on the Kamchatka salmon is being translated.

PACIFIC SARDINE STUDIES

During the past fiscal year, the *Black Douglas* made eleven cruises. Most cruises were made in cooperation with vessels of the Scripps Institution of Oceanography. The *Black Douglas* was used on four types of cruises.

1. *Surveys to determine distribution and abundance of sardine spawning, and rate of larval survival.*—A primary objective of the monthly oceanographic-biological survey cruises is the determination of the distribution and abundance of sardine spawning. A preliminary estimate of the number of eggs spawned during 1956 is approximately 200,000 billion. This is somewhat larger than the estimate for 1955 (163,000 billion), but smaller than the estimate for 1954 (355,000 billion).

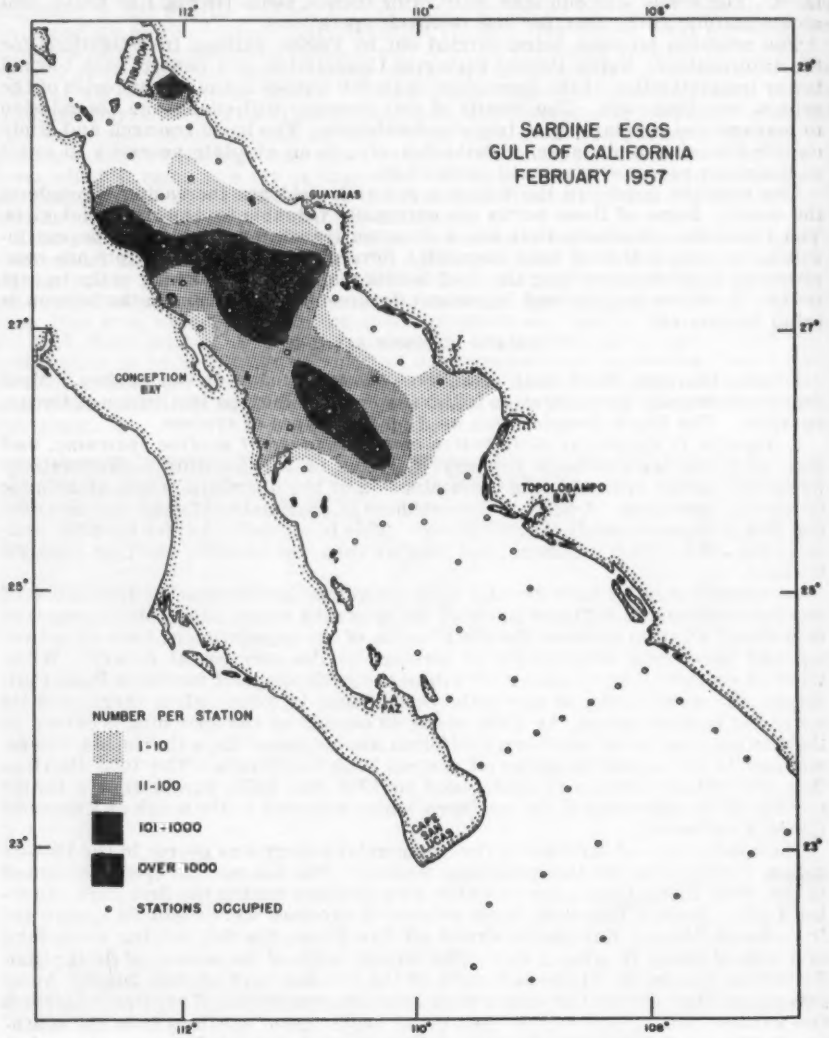
In recent years we have become very interested in the relative abundance of sardine spawning in different parts of the spawning range, since there appears to be a direct relation between the distribution of the population at time of spawning and subsequent availability of sardines to the commercial fishery. When there is considerable spawning off southern California and northern Baja California, the availability is markedly better than in years when there is little spawning in these areas. In 1956, about 43 percent of the spawning occurred in the northern center off southern California and adjacent Baja California, the remainder in the southern center off central Baja California. The 1956 distribution was rather similar to that found in 1954 and 1955, except that a larger portion of the spawning in the northern center occurred to the south of Ensenada (Baja California).

The availability of sardines to the commercial fishery was poorer in the 1956-57 season than during the two preceding seasons. The commercial catch amounted to less than 32,000 tons, most of which was obtained during the first dark (October 1–17). During this dark, large schools of sardines were followed southward from Santa Monica Bay to the strand off San Diego, the fish moving southward at a rate of about 10 miles a day. The largest catch of the season, of better than 5,300 tons, was made on the last night of the October dark off San Diego. At no subsequent time during the season were large concentrations of sardines observed. One explanation for the earlier than usual departure of sardines from the southern California fishing grounds is the rather marked changes in temperature that occurred during October. It is also likely that a smaller portion of the population was present on the southern California fishing grounds than in the preceding two seasons. The larval material collected in 1956 is being processed.

2. *Hydrographic-biological survey cruises in the Gulf of California.*—Except for a cruise of the *Black Douglas* into the southern part of the Gulf of California in late 1952, no work had been done on sardine spawning in the gulf prior to

February 1956. Since then, cruises have been made in February, April, and December 1956, and February, April, and June 1957, with a cruise also scheduled for August 1957. The station grid in the gulf consists of 12 lines of stations on which stations are spaced 15 miles apart, together with a fairly large number of inshore stations located between the station lines.

Sardine spawning in the gulf is heaviest in the middle third, between Carmen and Tiburon Islands. In this area, spawning occurs completely across the gulf. Interestingly, the distribution of spawning in February 1957 was strikingly similar to that found in February 1956, with the heavy spawning occurring immediately to the south of Guaymas.



The gulf cruises are spaced at bimonthly intervals during the current spawning season in order that an estimate of the sardine spawning population in the gulf can be obtained. It was evident from the results of the 1956 surveys that the sardine spawning population in the gulf must be a large one.

Of considerable interest is the abundance of Pacific mackerel spawning in the gulf. Pacific mackerel eggs and larvae occur throughout the gulf. They were

taken in 93 out of 129 plankton hauls made in the gulf in April 1956, for example. A larger number of Pacific mackerel larvae have been taken on each of three gulf cruises that have been worked up than are taken throughout the year on the outer coast.

3. *Collection of spawning sardines.*—The August and September (1956) cruises of the *Black Douglas* were devoted in part to the sampling of adult sardines for use in subpopulation studies, in part to egg and larval surveys of fall sardine spawning. During both months, sardines were sampled in the area between Point San Eugenio and Point Abreojos, mostly by gill netting. Age determinations were made on 89 sardines taken in August, 70 taken in September. The August material consisted of fish 0 to 4 years old, the September samples consisted of fish 0 to 6 years old; only about 5 percent of the fish were over 2 years old.

The material was examined to determine the state of maturity of the fish. Of those collected in August, only a sample of 22 fish from Hipolito Bay were maturing. All females in this collection had yolked eggs and several contained ova in fairly advanced stages of development.

A total of 50 fish, consisting of 27 males and 23 females, were examined from the September collections for stage of maturity. Of the females, 17 had yolked eggs and two contained ova that were becoming translucent.

In August the females that contained yolked eggs were between 177 and 222 millimeters in standard length; in September they were between 160 and 188 millimeters. Thus, smaller sized fish were maturing in the September collections; these fish were mostly 1 and 2 years of age. The high percentage of females that were maturing in September indicated that most of the fish sampled were definitely part of the fall spawning population. The marked difference in size between these sardines and fish of the same age taken off southern California is evidence that they did not enter into our commercial catch in any numbers in the 1956–57 season. It also adds support to the thesis that the fall-spawning sardines constitute a separate subpopulation.

4. *Availability studies.*—In October, November, and December, 1956, the *Black Douglas* made nightly plankton and temperature collections in areas scouted and fished by the San Pedro sardine fleet. As soon as the area of most intense fishing was ascertained on any given night, the *Black Douglas* executed a pattern of observations that included the fishing area, as well as some portion of the surrounding area that had been scouted without success. Once started, each pattern was continued until a half hour before dawn.

This survey is a field approach to the problem of sardine availability. Large concentrations of sardines do not necessarily appear in the same spot on successive nights, and indeed do not necessarily appear within operating range of the fleet on successive nights. It is reasonable to hypothesize that such fluctations are related to variations in one or more features of the environment. Not knowing, at the outset, which environmental factors might be critical, it was decided to measure plankton and temperature, which have been related to fish distribution in a few others fisheries. Plankton was collected with a Hardy continuous plankton recorder. Surface temperature was recorded continuously, and bathythermographs (temperature measurements to 400 feet depth) were taken at frequent intervals.

The plankton collections and the temperature data are now being processed but the data are not yet complete enough for analysis. Sixteen to twenty categories of organisms are identified and counted in each collection. Copepods less than 2 millimeters in length are by far the most numerous and they fluctuate by a factor of 3 to 4 during the course of 1 night. In one case, the area of highest density for the more abundant categories appears to be associated with a geographical feature of the adjacent coastline. The center of fishing, however, was in an area of lower plankton density about 4 miles away.

Since this was a relatively poor season, no really large sardine catches were made while the *Black Douglas* was operating. Obviously, the significance of plankton and temperature distributions as factors in sardine availability cannot be determined until collections are obtained on some number of good nights as well as poor nights of fishing.

The Scripps research vessel *Orca* covered a regular grid of hydrographic-biological stations off southern California each month during the period that the *Black Douglas* was working with the commercial fleet. A striking fact brought out by the *Orca* cruises was the marked lowering in temperature that occurred in the southern California area between the October and November cruises—amounting to about 2° over much of the area.

NORTH ATLANTIC TRAWL FISHES

1. *Flounders.*—Landings of the principal flounder species, yellowtail, blackback and fluke, at southern New England ports in 1956 did not differ significantly from 1955 figures. Slight increases in Rhode Island yellowtail and blackback landings appear to have been caused by the high abundance of small fish in catches from Rhode Island waters. There is evidence that strong year classes of both species are moving into the fishery which may increase the 1957 catch.

Growth studies have been concentrated on yellowtail flounder during the past year, but some fluke and blackback data have been collected for future work. Yellowtail otoliths (ear stones) were obtained, when possible, by monthly intervals during 1956 to provide evidence of the validity of the use of otoliths for age determination and to show the seasonal sequence in annual ring formation in otoliths. Only one complete ring, consisting of an opaque band and a hyaline band, is laid down each year, although the beginning of the second annulus is found before fish have reached the end of their first full year of life.

There is good correspondence between size of fish and age determined from otoliths, indicating that otolith rings are laid down in a regular manner. Modes in the length-frequency distributions of 1- and 2-year-old fish coincide with the modal lengths of age groups based on otolith readings. These modes corresponded closely during the course of a year and the average sizes within the young age groups increased regularly through the growing season. This information furnishes evidence that only one annulus is laid down each year.

Growth in length is rapid during the first 2 years of life; weight increases at a rapid rate for another year. Following the second year females grow at a significantly greater rate than males. Current work indicates that growth is faster at present than it was during the 1940's. Length-frequency samples of commercial catches show a smaller proportion of old fish in the catch than formerly. Work is planned to determine whether or not a real change in growth rate and age structure of southern New England stocks has taken place.

As a part of the yellowtail study, over 1,000 fish were tagged from commercial draggers on southern New England grounds in early 1957. These tagging experiments are designed to help delimit separate yellowtail stocks, if such exist, for individual consideration in future study. In addition, growth of recaptured fish should contribute substantially to the validation of otolith age and growth studies.

2. *Industrial fishery.*—Point Judith is, as yet, the only New England port most completely geared to the industrial fishery. Its fleet is of moderate size, about 60 vessels, varying from those classified as undertonnage (less than 5 net tons) to the upper limit of the small otter trawl classification (50 gross tons). Most of these vessels land split catches, that is, both fish for human consumption and fish for reduction. There are always a few trips that land pure catches of market or industrial fish, although not always the same vessels. The present study of the fish communities of southern New England waters is largely based on the catches of the Point Judith fleet. This report is concerned with some of the characteristics of this fleet, economic and otherwise, that will aid in interpreting the landing data collected.

The farther away from port the fishing ground, the higher expenses are likely to be, and the larger a vessel must be, and this will be reflected in the size of the catch. Even within the range of vessel sizes at Point Judith, this shows up clearly when the catch per trip is compared with the distance from port to the various fishing grounds. Roughly speaking this is 1,000 pounds of fish for each mile away from port. It may be said that this reflects abundance in that many more smaller vessels consistently fish on the nearer grounds, while larger and more seaworthy vessels venture farther offshore where the fishing is better. The number of trips made depends in part on the weather but mostly on the availability of the industrial fish. It is of interest that the catch of market species is inversely related to the catch of industrial species.

3. *Redfish or ocean perch.*—Redfish are landed at three major ports in New England: Gloucester, Mass., and Portland and Rockland, Maine. Since there is little interchange of vessels between ports and since the vessels fish the same general grounds at the same seasons of the year, the statistics of catch and effort collected at each port provide independent estimates of the abundance of redfish on the various fishing grounds.

Estimates of abundance vary with season and are affected by vessel size. There is a considerable range in the size of vessels fishing for redfish. The large trawlers fish the more distant grounds, while medium and small trawlers fish as

far from home as the condition of the vessel and the weather allow. The highest catch per day is made by the larger vessels fishing the more distant grounds.

Seasonal changes in the catch per day are influenced by the habits of the fishermen and the effect of weather. The Gulf of St. Lawrence fishery is limited to the period when ice is not present in the gulf. The first fishing in May and June usually results in a high catch per day which diminishes as concentrations of fish are thinned until cold weather again closes the area to fishing.

The Grand Banks are fished throughout the year, with a slackening of effort during the peak seasons in the Gulf of St. Lawrence. The highest catch per day is likely to occur at the resumption of fishing after the summer layoff.

Seasonal changes in the catch per day in the Gulf of Maine are caused by changes in the efficiency of the fishing fleet. The larger and more efficient vessels fish outside the Gulf of Maine during the better weather and return to the central gulf during the winter. The data are less clear than for the more distant grounds, although the trend of lower midsummer values in the central gulf is evident. The fleet fishing the northern Gulf of Maine is more stable and shows comparatively little seasonal change.

The catch per day for the Gulf of St. Lawrence has remained fairly constant as the Grand Banks value has dropped and the Nova Scotia banks values have increased. The Gulf of Maine has shown a slight annual increase to a point above 10,000 pounds per day's fishing. The fishery in this area has been stabilized between 7,000 and 9,000 pounds per day since 1949. Under present fishing conditions the fishery will probably be maintained within the limits which have prevailed since 1949.

Redfish were successfully tagged for the first time at Eastport, Maine, during 1956. A total of 3,385 redfish were tagged from the end of July until mid-November. The continued study of this group of redfish will produce valuable data on age and growth, migration, and natural mortality rate. Successful tagging of redfish has provided the first direct evidence on the growth of redfish. Almost 200 tagged fish were recaptured during a period of 9 months. The bulk of the recaptures was made during the first 3 months of the experimnet. The growth of the recaptured fish was extremely slow. The average growh recorded at the end of 9 months was less than 4 millimeters. The greatest growth recorded for a single fish was 10 millimeters. These findings are in accord with earlier estimates of growth from otoliths. Tagged fish reappeared at the tagging site in May 1957. It is anticipated that a sufficient quantity will be recaptured during the summer to substantiate further the present age and growth findings.

A large number of redfish specimens from all areas within the New England-Newfoundland area have been examined for racial comparisons. This study includes the enumeration of meristic (such as spines in the fins) characteristics and the measurement of a series of various body proportions. In some instances the meristic characteristics are compared to similar data from small samples of eastern Atlantic redfish.

The following statements summarize our present state of knowledge of North Atlantic redfish stocks and indicate the direction of future work:

(*a*) The original description of *Sebastes marinus* (the species common to the United States fishery) is too general and encompasses all of the redfish of the North Atlantic.

(*b*) *Sebastes viviparus* and *Sebastes mentella* (found mostly in northern waters) are not described precisely enough to permit their positive separation from the main *Sebastes* group.

(*c*) Two general body shapes are recognized as extremes with a great range of intermediate variations. These are roughly grouped as *marinus* and *mentella* types by European workers. The limits of these differences are not established.

(*d*) In recent taxonomic work, differences introduced as specific characteristics (eye size, length of jaw appendage, body shape) may be influenced by environmental factors such as water depth or temperature.

(*e*) Some of the greatest differences observed are in characteristics such as growth rate, body color, and size at maturity. These tenuous characters are suitable for identifying stocks of fish but not exact enough for taxonomic classification and may be influenced by environment.

Because of the inexact nature of the present taxonomy of the Atlantic redfish, it is difficult or impossible to evaluate observed variations in known redfish stocks. Before a *mentella* group can be described, it will first be necessary to define the *Sebastes marinus* group.

Fish tagged at Eastport during the past year show no evidence of migration, with all returns from the original tagging site. The evidence of earlier studies

has indicated no organized migrations of redfish, such as are observed among codfish, for example. In the Gulf of Maine, the size composition of the redfish remains stable from year to year within the limits of what appear to be separate populations.

A study of the incidence of the copepod ectoparasite *Sphyrion lumpi* (Kroyer) shows the distribution of parasitized fish is not homogeneous throughout the gulf. The pattern is consistent from year to year. Most of the parasitized fish are in the western part of the gulf, the count decreasing toward the east until it becomes zero around the Cape Sable region of Nova Scotia. The localized distribution of the ectoparasite suggests there is not much movement of redfish in the gulf. Parasites are known to be good natural tags as the parasites will appear on fish of one area but not in another.

4. *Sea scallops.*—Nineteen million pounds of sea scallops (*Placopecten magellanicus*) were landed in the United States during 1956. The catch was worth about $10.5 million as landed. About 50 percent, 9.6 million pounds, of the total catch came from eastern Georges. The average catch per boat per day for Georges Bank declined to 1,440 pounds, 9 percent below 1955 and 14 percent below 1954.

New Bedford, Mass., main port for the Georges Bank fleet, received landings of 14.0 million pounds. Trips from Georges Bank were also landed at Gloucester, Mass. (1.0 million pounds), Rockland, Maine (0.5 million pounds), and at Nova Scotian ports (0.7 million pounds).

Exploitation of the Georges Bank stocks by Canadian vessels is increasing. Since 1951, the Canadian offshore sea scalloping fleet has expanded from 2 to 10 boats fishing more or less regularly on Georges Bank. Three new vessels are reported to be under construction for this fishery.

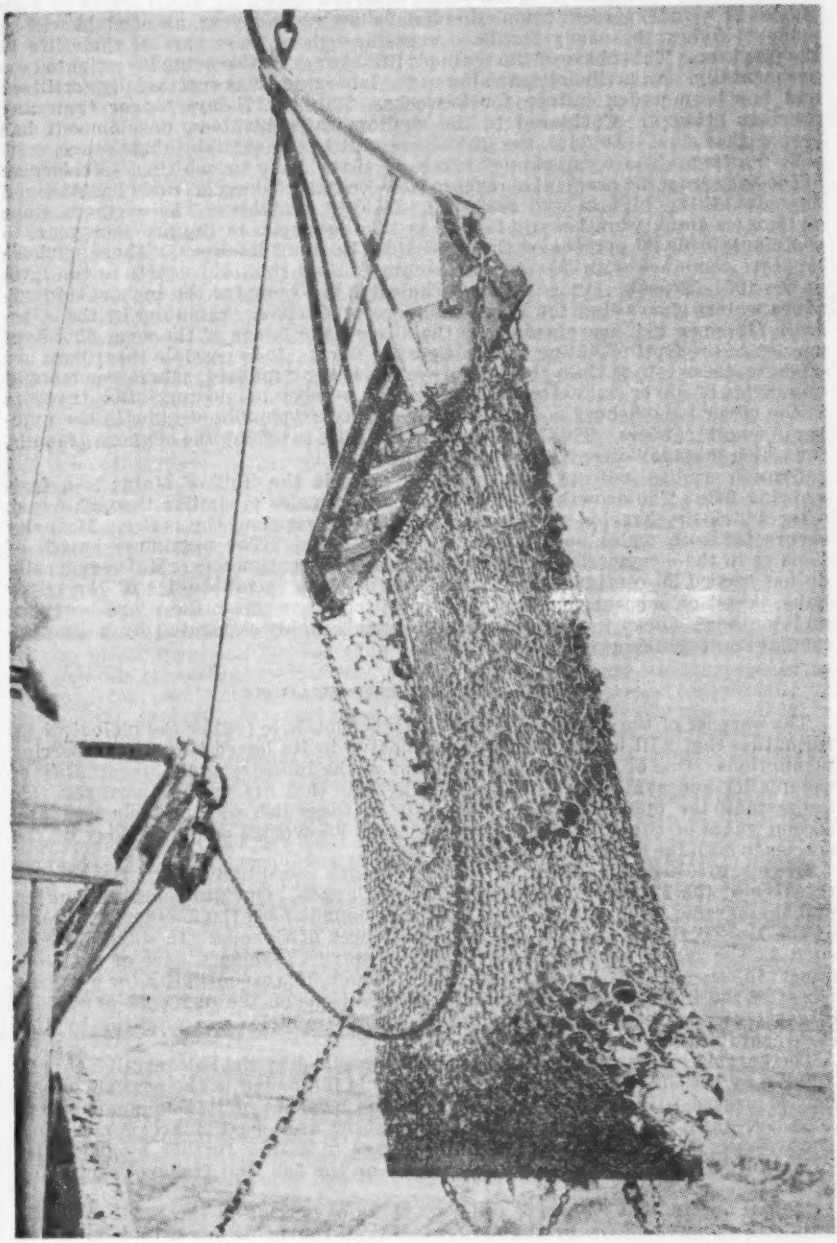
During the year, some 46,000 measurements of sea scallops were made from 93 commercial trips. Six of these were sampled at sea by project personnel. There has been a general decrease in size since the previous year; fewer large scallops and more small scallops were landed in 1956.

The concern of the industry over the decline in the catch per unit of effort and in the average size of the scallops being caught has led us to consider the available data on the Georges Bank fishery in the light of possible management procedures. Preliminary studies show that considerable increases or decreases in fishing effort would not have a great effect on the yield. On the other hand, a 30 percent increase in the yield is indicated if the age at first capture of sea scallops is increased 3 years beyond the age they are now caught.

Canadian investigations have shown that controlling the size of rings and links in the bag of the scallop dredge will control the minimum size of the scallops caught. Their results, however, are not strictly applicable to our problem because the tests were conducted with a type of dredge different from that used by United States fishermen. To determine the selectivity of dredges with various sizes of rings in the bag, the scalloper *Whaling City* was chartered in June 1957. The present standard ring used by the New Bedford fleet, 3 inches with a 1⅛ link was compared with 2-, 3½-, and 4-inch rings. Each of the experimental bags had a netting section of the same size square mesh as the inner diameter of the rings. The results of the cruise have not yet been fully analyzed. Another cruise is planned for July.

The growth rate used in the population dynamics calculations was established from an analysis of the modes of length frequency distributions. Two other methods of estimating the growth rate, tagging and shell reading, are under investigation. Some 3,000 scallops were tagged and released on Georges Bank last year. There have not been a sufficient number of returns to date to warrant any conclusions on rate of growth. Canadian investigators have been able to determine the age and growth of sea scallops from their stocks by counting and measuring annual rings on the shells. The rings on the Georges Bank scallops are much less distinct than those on the Canadian scallops. In addition, they are usually masked by a great many extraneous marks. These conditions make them very difficult to analyze for purposes of determining age. We intend to continue our efforts to validate the shell-reading method of estimating the growth rate.

The total mortality rate was estimated by separating the length frequency distribution of the catch sample into year classes on the basis of the estimated growth rate. The accuracy of this estimate is, of course, dependent upon the accuracy of the growth rate. The mortality rate will be tested during the coming year by a large-scale tagging experiment. Several thousand scallops will be tagged and released in an area that is being actively fished. The rate of return of the tagged shells will provide an estimate of the fishing mortality rate and may provide data on the magnitude of natural mortality.



A typical scallop dredge constructed of steel rings.

Last year, the date and duration of spawning of the Georges Bank sea-scallop population was observed for the first time. A staff member, at sea on a scallop fishing boat in anticipation of the event, observed spawning which began on September 21 with 95 percent completion 3 days later. This year, an attempt will be made to follow the newly fertilized eggs through at least part of their life in the plankton. This phase of the scallop's life history is also being investigated experimentally. An artificial spawning in the laboratory was successfully fertilized and has been under culture for 3 weeks. This is 17 days longer than any previous attempt. Compared to the shallow-water bivalves, development has been rather slow. To date, the larvae are still in the straight-hinge stage.

5. *Whiting.*—The total annual catch of silver hake or whiting (*Merluccius bilinearis*) from the productive inshore New England fishing grounds has declined from its alltime high in 1951 and 1952. In 1956, grounds on the northern slope of Georges Bank were heavily fished, as they had been in the previous year, to contribute over 30 percent of the total New England landings. These offshore landings combined with the inshore landings raised the total nearly to the level of the 1951–52 peak. An analysis of the catch per hour for the inshore and offshore waters shows that the latter are more productive. Sampling by the *Albatross III* since 1948 has shown that the silver hake is one of the most abundant species in the Gulf of Maine and on Georges Bank. It is possible that there are offshore areas, other than the one presently being exploited, where commercial quantities of silver hake are available. The number of medium otter trawlers in the silver hake fishery is increasing, with a corresponding decline in the number of small trawlers. This trend reflects the shift to fishing the offshore grounds, for which the small otter trawler is not suitable.

Growth studies indicate that the silver hake in the Gulf of Maine is a fast-growing fish. The growth rate for males and females is similar through age 4, after which the females grow larger and live longer than the males. Maturity occurs for both males and females at about age 4. The maximum length of females in the commercial samples is generally 52 centimeters. Males generally do not exceed 36 centimeters. At the present time, racial studies of the silver hake, based on measurements of body proportions, suggest there are northern and southern stocks in New England waters, roughly separated by a line extending southeast from Cape Cod.

ATLANTIC HERRING INVESTIGATIONS

The purpose of the Atlantic herring investigation is to gather the biological information that will benefit the fishing industry in its harvesting of the herring populations. One of the principal problems of the industry is the uncertainty of the quality and availability of the small herring that are used as sardines. To understand the fluctuations in the supply of these fish during their first and second years of life requires a comprehensive knowledge of the biology of the species in both the immature and mature stages.

In this investigation, many of our efforts are coordinated with the herring research of the Fisheries Research Board of Canada. Our problems are similar, and the herring occur in the ocean area that bounds both the northeastern coast of the United States and the maritime provinces of Canada. In some projects, such as the larval herring surveys, both countries assume a part of the joint effort; in other instances one country may assume the responsibility for a certain phase of the investigation, for example observations on the incidence of various diseases among the herring populations. Both countries are profiting by this close coordination of effort.

The herring studies are financed by funds provided by the Saltonstall-Kennedy Act and by the State Department. The latter is interested in the possible effects that a proposed tidal dam would have on the fisheries of Passamaquoddy and Cobscook Bays, which are in an important fishing area, particularly for herring. These State Department funds are being used to gather further biological information on herring, with special emphasis on the fish that frequent the region of the proposed dam.

Population studies: Are there different races of herring in the North Atlantic region, and particularly in the Gulf of Maine, the principal fishing area for sardines? This problem is being studied in a number of ways.

A comparison of the number of vertebrae from fish of the same year class is a classical method for racial analysis. A study of both mature, spawning herring and those in their first year of life is in progress, but the work has not advanced to a point where definite conclusions can be made. Difficulties in age

determination have hampered efforts to separate the large fish into various years classes, and this is a problem that must be solved before the vertebral counts can be analyzed.

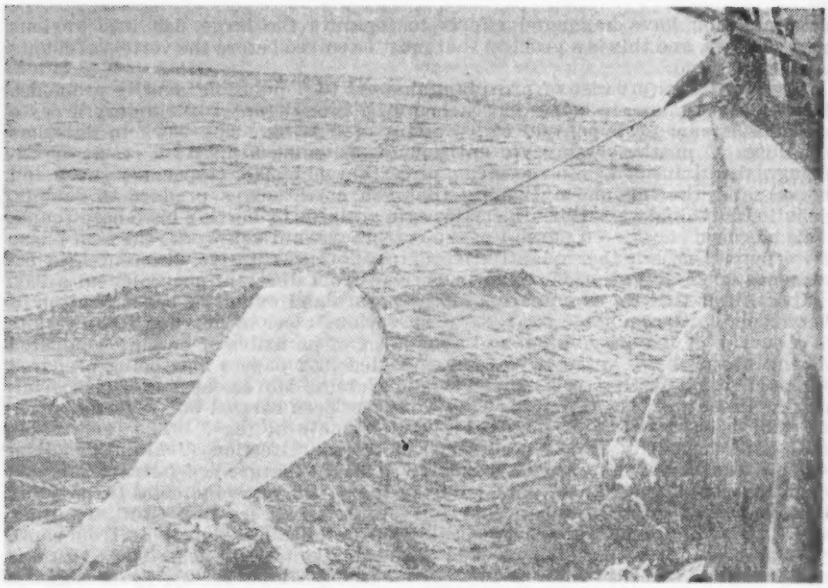
Serology offers promise of providing answers to population identity problems. Serological studies are being approached on a broad front, utilizing erythrocyte antigens, serum proteins, and egg proteins of herring. The work to date has concentrated on the erythrocyte antigens of spawning fish. As a result of utilizing natural antibodies in the serum of certain mammals (especially sheep and horse) and the immune antibodies that fish erythrocytes produce in rabbits, definite individual variations in erythrocyte antigens of herring have been found. This has been considered phase 1 of the erythrocyte antigen work; the next phase is to determine whether quantitative or possibly qualitative differences in occurrence of these variations exist in herring from different geographical areas.

It was felt that an examination of the nature and extent of parasitization of herring might be valuable for separating various races of herring. The results of a survey of the distribution and abundance of parasites of herring conducted during the past 2½ years have been embodied in 2 papers now being prepared for publication: Parasites as Indicators of Herring Movement and Myxosporidiosis in Immature Sea Herring. This work has been carried out with the premise that certain parasites may be useful as "natural tags." The remarkable lack of homogeneity in the occurrence of fungus infection (*Ichthyosporidium hoferi*) and larval cestodes (Trypanorhyncha) in mature sea herring sampled from Newfoundland to New Jersey during the past 3 years indicates little if any interchange of adult fish between Gulf of St. Lawrence and Gulf of Maine, and a possible discontinuity between Gulf of Maine adults and those from south of Cape Cod. Myxosporidian (*Kudoa clupeidae*) and larval nematode (*Anisakis* sp.) incidence in Gulf of Maine immature herring sample for 2½ years suggests the existence of at least 2 subpopulations of such immature fish with a transition area at Penobscot Bay, and with only minor straying of fish during their second year of life from the western to the eastern Maine coast.

Tagging is an important method for studying the migrations of herring and the degree of possible mixing of various races of herring. The use of natural tags can be supplemented by manmade tags, and holding experiments have been carried on in Boothbay Harbor to determine the feasibility of various types of marks, both internal and external. Plastic opercle tags and tatooing appear to be promising, particularly for the small fish that will be handled individually by the sardine packers. Internal metal tags, used successfully elsewhere on large fish that are handled in bulk for fishmeal, have a somewhat limited value for small fish, for the chances of recovering such tags at a sardine cannery are slight. Further studies of possible tagging methods will be continued.

Disease studies: Since 1947, a continuing examination has been made of a systemic fungus disease of herring of the Gulf of Maine where at the present time the disease is at a low endemic level, with incidences well under 1 percent. Quite the opposite situation has prevailed in the Gulf of St. Lawrence, however, with an epidemic peak of this disease in the period 1954–56. With the cooperation of the Fishery Research Board of Canada and the Department of Fisheries of the Province of Quebec, this epidemic has been followed closely, since information gained during this period may have application in the Gulf of Maine. The outbreak has seriously decimated the herring population of the Gulf of St. Lawrence. Sampling disclosed that one-fourth of the herring of that area were affected in 1955 and a somewhat smaller percent in 1956. Landings of herring have declined sharply during this period, probably due to the effects of this disease.

Experimental work conducted during this period at Boothbay Harbor has indicated that (1) the incubation period of the disease is from 15 to 30 days, (2) the severity of infection is directly related to the infective dose, (3) virulence of the disease organism is not different at the epidemic peak than in the trough of the epidemic wave, and (4) the disease may occur in either of two phases—acute or chronic—the acute being terminal before 30 days, the chronic being progressive and sometimes fatal after longer periods. Using an antigen-treated-erythrocyte technique developed recently for the diagnosis of weak antibody responses, it has been possible to demonstrate the presence of antibodies to the fungus in blood sera from infected herring. Further refinement of antigen extraction is necessary before this technique will be useful in prediction of epidemic peaks.



Plankton net used for taking herring larvae.

Relating to acute and chronic phases of the disease, characteristic changes in electrophoretic patterns of herring serum have been determined. The acute infection results in a pronounced reduction in the lead anodal peak and enhancement of a slower moving fraction behind the second peak, possibly associated with antibody formation. Chronic infections are characterized by a continued depression of the lead anodal peak and a persistence of a slower moving fraction noted above.

While many questions remain unanswered and much more research is needed, this work, built upon a background of information already available, places this serious disease of herring among the better understood of marine-fish diseases.

Year-class fluctuations: The causes for the fluctuations in the survival of year classes of herring during the first year of their lives represent a problem that may be solved by oceanic research. The strengths of the year classes directly affect the sardine industry, which depends on the supply of small herring that are available between the ages of about 10 and 22 months. Thus, the poor survival of a year class before it reaches canning size at an age of about 10 months results in a mediocre pack and a resultant economic disturbance throughout the industry. To understand the fluctuations in mortalities from year to year requires a knowledge of the spawning grounds, the success of egg laying and hatching, the drift of the larvae, and the conditions that govern their survival. Such an understanding can be obtained only by research that is performed over the ocean areas where the herring spends its early life. At present the area to be investigated is not clearly defined; certainly, the long larval lives—as long as 7 months for autumn-spawned fish—enable the larvae to be carried long distances by currents. Our present studies in the Gulf of Maine, between Nantucket Shoals and the southern tip of Nova Scotia, may have to be expanded further.

An intensive larval herring study was initiated in September 1956 in a coordinated effort of the Fisheries Research Board of Canada and the United States Fish and Wildlife Service. On each cooperative cruise, the Canadian ship M. V. *Harengus* traveled about 1,400 miles along the inshore area of the Gulf of Maine, while the United States ship M. V. *Silver Bay* cruised about 2,000 miles in offshore waters of the Gulf of Maine and on Georges Bank. Three monthly joint cruises were completed between September and November 1956. The *Silver Bay* also made a special trip to the Bay of Fundy during November

and another to Georges Bank in December. Between cruises the *Harengus* was also occupied with experimental transponding drift buoys that were designed to yield information on the surface-water currents on a herring-spawning ground off the southern tip of Nova Scotia. The monthly cruises were continued by the United States research ships M. V. *Delaware* and *Albatross III* during January and February 1957.

One-meter plankton nets and the Hardy continuous planton recorder were used to collect plankton on the cruises. These plankton collections have yielded considerable information about the distribution of herring larvae. In September, the heaviest concentrations of herring larvae were on Georges Bank. In October, the larvae were still abundant on Georges Bank but were more widespread and had increased in size from the 5–10 millimeter range in September to 8–16 millimeter in October. In November, the Georges Bank larval concentrations were more widely distributed and the larvae had grown to lengths of 12 to 28 millimeters. During December, a special cruise was made to Georges Bank to collect larvae, which had then increased to a size range of 15 to 29 millimeters. In the following months, January and February, the larvae were from 25 to 40 millimeters. From the results of the larval cruises it is apparent that the Georges Bank area was a most important spawning ground and that it is possible to trace the movement of the herring during the larval period.

Because of fiscal restrictions it was not possible to follow the movements of the larval herring after February. This is an important phase of the investigation that must be pursued in the future, for it is of utmost importance to learn whether the great offshore spawning grounds on Georges Bank contribute to the inshore populations of small herring.

It is important to identify the currents that may influence the distribution of the herring larvae. In conjunction with the plankton work and with the cooperation of the Woods Hole Oceanographic Institute a total of over 4,700 drift bottles were released by the research vessels. Returns from these bottles have confirmed the general theory of water circulation in the Gulf of Maine. There are definite limitations in the use of drift bottles, and the use of transponding drift buoys is desirable for a clearer understanding of surface-current patterns.

GULF OF MEXICO FISHES

Shrimp studies

There are four species of commercially important shrimp in the Gulf of Mexico: The white shrimp, *Penaeus setiferus*; the brown shrimp, *Penaeus aztecus*; the pink shrimp, *Penaeus duorarum*; the seabob, *Xiphopenaeus kroyeri*. The seabob is of minor importance, seldom being exploited outside of Louisiana waters. In most areas of the gulf, however, the catch included at least two of the remaining species, the relative abundance of each varying according to time of year as well as locality.

With shrimp, as with other commercial fisheries, the maximum yield can be achieved at that point when the increase in weight of the population due to recruitment and growth equals the decrease due to mortality and migration beyond the effective range of the fishery. In the shrimp fishery where two or more species are exploited, the problem is complex. Differences between species in spawning seasons, spawning areas, growth rates, distribution, movements, and behavior must be considered. In short, the biology of the individual species that comprise the commercial catch and their interrelationships must be evaluated before any valid conservation measures can be formulated.

The complexity of a fishery of this type is being studied in the Galveston area. In this area the present shrimp fishery is based primarily on the white and brown shrimp. One or the other is the dominant shrimp species depending on the time of year. Occasionally pink shrimp and seabobs constitute a portion of the catch.

A detailed study of the commercial and bait fisheries in this area has been started. Growth and mortality rates are only of academic interest without some measure of abundance of each species. Although statistics are being collected presently on the commercial fishery, the bait fishery has been overlooked. Since over 200 bait dealers in the area sell an estimated 1 million pounds of shrimp annually, the status of the shrimp bait fishery is to be established.

The Galveston Bay area has been subdivided into small statistical areas to obtain an accurate survey. Detailed statistics and regular samples are being obtained from both the commercial and bait fisheries.

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These statistics and samples will be analyzed with the following objectives in mind:

1. Determine the relative abundance of each species in this area and follow changes in size and species composition of the shrimp population.
2. Learn more about the movements and interrelationships between species.
3. Define spawning season and spawning grounds by gonadal examination of samples.
4. Develop a method of following discrete shrimp population.
5. Determine the growth of shrimp under natural conditions.

A field program was initiated in Lufkin Bayou (a natural inlet on Galveston Island) to determine the effects of various environmental factors on the growth and abundance of shrimp in a nursery area and the interrelationships between brown and white shrimp, in particular, the study of comparative movements within the estuary and the degree of competition between species.

Marking methods developed under contract were tested in the Galveston laboratory. Since the contract work was confined largely to adults, the work in the laboratory emphasized the marking of smaller shrimp.

Chopped fish stained with Trypan Red was fed to immature white shrimp, 25 to 35 millimeters long. Seven feedings were required before a pink coloration of the gills was detected. Eleven feedings produced a bright red color in the gills. The bright red color was lost after two months, but 90 percent of the shrimp still showed a recognizable pink color. F. D. C. Green No. 3 and F. D. C. Blue No. 1 were similarly tested, and although each stain caused an abnormal color in the digestive tract and heart of the shrimp, neither produced a persistent color. Shrimp immersed in a dilute solution of riboflavin and shrimp fed with mullet previously soaked in riboflavin became luminescent for approximately 3 days. A large holding tank was constructed and was placed in the field to conduct a field test of the staining method in the immediate future.

Temperature tolerance limits of 4° to 40° were tentatively established for postlarval white shrimp. Salinity limits were determined under varying conditions. The toxicity of an insecticide containing 8.1 percent benzene hexachloride was determined for two species of shrimp. Test results showed a mortality of 83 percent at a concentration of 50 parts per billion of the insecticide for larger shrimp and 50 percent at 75 parts per billion for smaller shrimp.

The Tulane University contract on the anatomy of white shrimp was completed and an atlas of illustrations of this work will be published in the near future. Another contract was formulated with Tulane University to describe the anatomy of brown and pink shrimp, the other two commercially important penaeids of the gulf.

The Texas A. and M. Research Foundation under contract for histochemical and histological studies of shrimp has determined the flow of blood through the gills of shrimp and completed detail histological studies of the gills. In related studies they established that volume is a more sensitive index of growth than length. Volume measurement can be more easily established with live shrimp and the percent increase is three times greater than the percent increase in length.

Red tide studies

For the second consecutive year, the red tide organism (*Gymnodinium brevis*) responsible for mass fish kills near the Florida gulf coast, has not been present in lethal concentrations. A number of red tides were reported during the year, but with one exception all proved to be false or harmless phytoplankton blooms. The one exception occurred during December 1956 when a small number of dead fish were observed in the vicinity of the Ten Thousand Islands, but the fish kill was not associated with a *G. brevis* bloom.

The incidence of occurrence of *G. brevis* increased during the latter part of October and early November 1956, but the concentration of organisms remained low. In April 1957 the incidence of *G. brevis* began to increase and this trend was generally continued. In addition, the concentrations of *G. brevis* have increased gradually since May 1957. The concentrations are still small compared to those of a fish killing bloom, but if the trend of increasing concentrations continues, fish killing concentrations could develop in the next 4 to 6 months. The occurrence of fish killing blooms apparently depends on a delicate balance of several factors and the trends of increasing incidence and concentration of *G. brevis* has followed a trend of higher than normal precipitation. Higher than normal precipitation is considered a primary prerequisite of red tides.

The float type aircraft has been used to good advantage during the past year. Numerous reports of fish kills have been investigated by aerial reconnaissance

and plane sampling and the results are normally known in a matter of 3 or 4 hours, although the reports may be from any area of a 250-mile sector of the southern Florida coast. Weekly aerial surveys detect suspected areas of trouble much faster than would be possible otherwise.

Studies on the association of red tide with certain climatic and hydrographic conditions have been continued but the progress on these studies was retarded because of the loss of key personnel during the year. These studies will receive increasing emphasis during the forthcoming year. The purpose is to develop a red tide forecasting method and although a method has not been developed, the climatic and hydrographic conditions have been followed closely during the past year. This limited study indicates that accurate red tide forecasting may depend, to a great extent, on accurate long-range weather predictions .

No field studies on the control of red tide were conducted during the past year because there were no red tides. The supplies of powdered copper sulfate, the best known control agent, have been maintained in readiness in case a red tide does occur. Since preliminary field and laboratory tests indicated that the toxicity of copper may vary, laboratory studies were conducted to determine the factors which may increase or retard the toxicity of copper to *G. brevis*. These studies tested numerous factors, but the outstanding results were that the presence of certain other metal ions, especially iron, nickel, silver, mercury, and zinc, increases the toxicity of copper, whereas the presence of suspended matter, chelating substances, soil extract, and sulfide ions decrease the toxicity of copper. A combination of several factors could drastically change the concentration of copper required to kill *G. brevis*. The results of these tests show that a preliminary laboratory test of sea water samples from a red tide area should be conducted prior to field experiments using copper sulfate. The laboratory test could be conducted in less than 24 hours and it should give an accurate index of the amount of copper sulfate required to kill *G. brevis* effectively in that particular bloom.

Studies on the toxic substance(s) produced by *G. brevis* indicate that the toxicity of a culture increases if the cells cytolyse (break open). Preliminary experiments indicated that the toxic components are heat-labile organic compounds.

Preliminary surveys have been conducted in the Galveston Lagoon as a part of a study of the use of copper ore dikes as a possible source of copper for long-term control of red tides. A survey of the lagoon including the bottom topography was completed and a large scale map was prepared. Preliminary studies of the currents of the lagoon were conducted. Laboratory studies of the toxicity of copper to organisms that occur in the lagoon indicate that a copper concentration of 0.25 parts per million reduces the life expectancy of young pinfish (*Lagodon rhomboides*) by at least 50 percent. Young croaker (*Micropogon undulatus*) and striped mullet (*Mugil cephalus*) are similarly affected by 0.5 parts per million of copper. Lowering of the salinity seems to augment the toxicity of copper. Grass shrimp (*Palaemonetes sp.*) were more tolerant of copper than the fish tested—a concentration of 10 parts per million had no apparent effect on the shrimp after 10 days . The ova of *Palaemonetes sp.* were tolerant of copper concentration as high as 20 parts per million.

Results of additional studies of the currents near the Florida gulf coast reveal a general northward drift occurs from Cape Romano to Boca Grande but near shore there are strong tidal currents which dominate the water movement.

Preliminary studies were conducted on the bioassay of sea water samples with *G. brevis*. This assay is designed to determine the suitability of sea water from various stations of the red tide area for the growth of *G. brevis*. Preliminary results indicate that a bioassay of this type may be a valuable aid in forecasting red tides and for determining the chemical conditions that are required to produce red tides.

Florida commercial sponge investigation.

This study was performed under contract with the Marine Laboratory of the University of Miami, Coral Gables, Fla.

Sponging up to December 1956 has been quite successful, but poor weather in the Everglades area from January through March prohibited fishing. Good sponges in quantity were also being taken in 7 to 9 fathoms of water off Anclote Key, but good sponge producing areas are widely scattered. The effects of sponge disease continues to cause serious deformation of the sponges throughout much of the area. The price of sponges has increased during the past year.

A growth curve has been devised for sponges of specific areas. This development may make it possible to project the growth data and estimate the years required to obtain a given diameter-sized sponge and to examine the productivity of sponge beds and the validity of conservation recommedations.

Present data indicate that the spawning temperature range is from 73° to 83° F. and there appear to be a temperature cline associated with minimum reproduction size. The minimum reproducing size sponge is 5½ inches in diameter in the northern part of the range and 4 inches in the southern areas.

Data on environmental factors which affect the growth, reproduction, and distribution of sponges have been compiled. Preliminary analyses of these data have been completed.

STRIPED BASS INVESTIGATIONS

North Carolina program

Albemarle Sound, N. C., embraces the greatest abundance of striped bass in the State. Present evidence indicates that the Roanoke River is by far the most prominent striped bass production tributary of the sound. Sustained abundance of the population has been threatened recently by the construction of dams and by an increased pollution load in the Roanoke River. To resolve the problems confronting the fishery a cooperative study for intelligently developing this river basin by scientific means became necessary.

In carrying out this program the Fish and Wildlife Service during the past 2 years has conducted a large scale tagging and recovery program at various points in Albemarle Sound, and among all types of fishing gear employed. The purpose of this study is to determine annual population magnitude and hence changes in size, related to alteration of river conditions in spawning areas. Catch and effort data have also been tabulated for 2 years since North Carolina recently abandoned its system of gear licensing. This was carried out by contacting dealers and fishermen throughout the sound, and fixed gear was counted by airplane to check the validity of information obtained by direct contact with operators of this type gear. Commercial striped bass catches were sampled 2 to 3 times weekly for age and size class composition by gear. Two years' data relating to the above categories are currently undergoing analysis.

A study of sex ratios among Albemarle Sound striped bass was necessary to determine the effects of selectivity of gill nets on both sexes in spawning populations prior to their entry into the tributaries. This cannot be accomplished on striped bass by visual observation. Furthermore, this species is shipped out of State in the round, making internal inspection impossible. A new technique has been developed as part of this investigation to facilitate sex ratio studies which allows sex determination of fish in commercial catches without impairing market value.

Large striped bass (20 to 40 pounds) were tagged at Oregon Inlet on the ocean in December 1956 to determine their relationship to Albemarle Sound populations or to those of other areas. Several of these fish have already been recaptured in Albemarle Sound, Chesapeake Bay, and off Sandy Hook, N. J., exhibiting in some cases that there is rather long-range coastal movement, and that coastal populations are exploited by several Atlantic Coast States.

In the spring of 1957, a second year study of the Roanoke River population was made, encompassing an estimate of the size of run and a compilation of catch-effort data. Embryological and morphological studies were made of eggs and larvae under controlled laboratory conditions to test the degree of survival under varying river conditions and for facility in distinguishing larval striped bass from other related species.

Preliminary results from adult striped bass population data show that the spawning runs of 1956 and 1957 were almost identical in size. In 1957, however, there was a decrease in catch of approximately 10 percent and a decrease in fishing rate of approximately 1.5 percent.

Spawning ground studies have shown that the bulk of spawning in the Roanoke River takes place from river mile 60 to river mile 137, the upper segment being in the zone of heavy concentration of industrial and domestic sewage pollution. It has also been shown that the entire river from its mouth to Roanoke Rapids Dam (mile 137) is utilized by striped bass for either spawning or the development of larvae. Post larvae have been collected as far downstream as river mile 6 in a polluted area heretofore believed to be avoided by young fish.

Chesapeake Bay program

In February 1957 a Chesapeake Bay striped bass investigation was organized between the Fish and Wildlife Service and the States of Virginia and Maryland. Primary objectives are (1) to determine the percentage of striped bass spawned and reared through the first 2 years in Chesapeake Bay that take part in northern coastal migrations; and (2) to measure the rate of exploitation of Chesapeake Bay stocks by sport and commercial fisheries inside and outside the Bay. The initial tagging program was begun as a 1-year pilot experiment for the purpose of obtaining information as to availability of fish for study; to select the most satisfactory tag types and procedures; and to study striped bass movement both within and outside of Chesapeake Bay. To date a total of 2,700 fish have been tagged by the participating agencies, and 400 tags have been recovered. A more detailed study of biological and fishing effects upon these populations will be possible when current analyses of the 1957 data are completed.

MENHADEN RESEARCH

The economy of the Atlantic and Gulf States is affected considerably by the seasonal and annual fluctuations in yield of the menhaden fishery. Knowledge of the causes and magnitude of such fluctuations would greatly assist the menhaden industry in developing and planning its fishing operations. Accordingly, a program of biological research of the Atlantic menhaden resource was undertaken in 1955 to determine the causes of fluctuations in the catch and the extent to which these may be predictable.

Research objectives

1. To investigate the life history and biology of menhaden in order to understand changes within populations and their effect on the fishery.
   (*a*) Determine the geographical distribution and interrelationships of the natural biological population of menhaden along the Atlantic coast.
   (*b*) Follow the changes in age and size composition from year to year to determine the relation between fluctuations in the catch and changes in the structure of the populations.
   (*c*) Follow movements and migrations of fish and their effect on the seasonal variations in abundance in different localities.
   (*d*) Accumulate information on spawning and early life history.
   (*e*) Obtain estimates of growth, recruitment, and mortality rates for determining the condition of the fishery.
2. To obtain measurements of catch, abundance, and fishing effort over a period of years for purposes of interpreting fluctuations within and between areas.

Results of investigations

1. *Populations of menhaden.*—Detailed examination of many thousands of juveniles and adults, collected over the presently known range of the fish, has indicated that two species of menhaden occur along the Atlantic coast of North America, the Atlantic menhaden, *Brevoortia tyrannus*, and the yellowfin menhaden, *Brevoortia smithi*. The vast bulk of the landings of the commercial purse seine fishery is comprised of Atlantic menhaden, and only isolated individuals of yellowfin menhaden occur in the catches south of Cape Hatteras. The latter rarely, if ever, occurs in the Middle Atlantic States and northward. It reportedly was common in the catches around Beaufort, N. C., three or four decades ago, but has not occurred in the landings in this area in recent years.

Atlantic menhaden presently are known to occur from Casco Bay, Maine, to Indian River, Fla. Yellowfin menhanden now range from Sapelo Marsh, Ga., to Indian River, Fla. In the latter area yellowfin menhaden support a commercial bait fishery which operates throughout the year.

Generally, the yellowfin menhaden is distinguished from Atlantic menhaden by its smaller, shorter head, deeper body, and single, dark shoulder spot; it is more silvery in appearance and has a yellow-tinged tail. Size and arrangement of the scales are the most distinctive specific differences. The yellowfin menhaden has 60 to 75 irregular, oblique rows of scales as compared with 40 to 55 regular, oblique rows in the Atlantic menhaden.

As both species have been found to occur together in Florida waters during the season of spawning, the possibility of hybridization should not be overlooked, and, indeed, a number of juveniles resembling both forms have been taken from

several locations. Because of its restricted range and infrequent occurrence in the purse seine fishery, the yellowfin menhaden is of minor importance to the investigation at present.

It is further necessary to know whether each species is further subdivided into independent or semiindependent populations. A single population of menhaden freely intermingling, spawning, and migrating along the coast would mean that fluctuations would be widesperad. If, on the other hand, there is a number of semiindependent populations, fluctuations would tend to be localized, and differences in spawning time, feeding grounds, and nursery areas very likely would result in differences in rates of growth, recruitment, and mortality. A great deal thus depends on the existence or nonexistence of distinct or semidistinct populations.

There are two lines of approach to the solution of this problem: the indirect method of counts of various body parts, or meristic characters, and the direct approach, by means of tagging. The problem thus far has been attacked from the point of meristics.

During the past 2 years, samples of juvenile fish have been routinely collected from 36 estuarine nursery areas along the Atlantic coast from Gloucester Harbor, Mass., to Indian River Fla. Collections of meristic data on 1-year-old fish also have been made.

To date comparisons of average numbers of vertebrae, fin rays, and ventral scutes of juveniles reveal that rather large differences exist between juveniles inhabiting estuarine nursery grounds north of Long Island and those occurring south of Long Island. Furthermore, juveniles from northern nursery areas are considerably smaller than those south of Long Island, and thus reasonably could not have originated from the same spawning.

From these findings it is hypothesized that adult fish segregate into at least two major groups for spawning, and the differences exhibited in body structure of juveniles are induced either by inherited tendencies which are preserved, or differences in environmental conditions at the time of spawning, or both.

Additional knowledge bearing on the identification of population structure is provided by studies of the distribution of spawning in space and time, based on the degree of sexual maturity of the gonads of the fish. Differences in temperature and other factors during spawning may give rise to identifiable differences in morphological and physiological characters. Hence, knowledge of the time and place of spawning and the nature of related environmental factors would be of aid in interpreting the results obtained from our meristic studies. Results of spawning studies will be discussed in a later section.

Persistent differences in the size of menhaden of the same age also are evident. One-, two-, and three-year old fish are considerably larger, on the average, in the northern limit of the range-of-a-year class, intermediate in size in the central part of the range, and smallest farther toward the south. Also, studies of the growth pattern in scales show differences among fish of the same age inhabiting different localities. Thus there is evidence that the fish are not randomly mixed throughout their life span.

Counts of meristic characters of spawning adults also are being made to determine the extent to which they resemble juveniles from adjacent nursery areas. This work is continuing, and it is believed that within the next year or two, we should be able to make reliable estimates of the degree to which fish in various places along the coast intermingle.

2. *Age and size composition.*—Knowledge of the age of menhaden is essential for determining growth, recruitment, and mortality rates, all of which are requisite to the problem of fluctuations. It is necessary, therefore, that we accurately identify the age of individual fish, and a large part of our efforts during the past 2 years has been devoted to establishing the validity of marks on the scales as age indicators.

Examination of scales of many thousands of fish of various sizes has shown that clearly defined marks or "rings" occur on these structures with certain regularity. By following the pattern of scale growth each month that fish of the 1951 year class were available over the past 5 years, it has been established that 1 "ring," or annulus, is laid down on the scale for each year of life. Similar findings for subsequent year classes have further confirmed our interpretation of scale "rings" as being reliable annular marks. The new annulus appears on the scales in the spring months.

To discover whether fluctuations in the fishery result from variations in year class strength, it is necessary to know the age or size composition of the menhaden population from year to year in order to connect fluctuations in the catch

with changes in the structure of the population. Age composition is being determined routinely from representative samples of the commercial catch. Samples are taken each day throughout the season that vessels are fishing at 10 locations between Portland, Maine and Fernandina, Fla. The number of daily samples is roughly proportional to the catch in each locality.

Results of this work show conclusively that an unusually abundant or "dominant" year class has had a terrific impact on the fishery in recent years. The progression through the fishery of the dominant 1951 year class is obvious. Its contribution was clearly reflected in the commercial catch in 1953 when production in this area reached an alltime high of over 378,000 tons. The continued effect of this year class on the fishery in 1956 is evident. Record catches were made in the northern areas in that year. The contribution of this year class to the 1956 catches can be fully appreciated when it is realized that individual fish in this age group averaged about 1⅓ pounds in weight. In other words, the contribution of this year class to the northern fishery comprised over 50 percent of the total catch by weight, while in the North Carolina fishery it comprised nearly 40 percent.

Continued study of the annual variations in abundance of age groups over a period of several years might make it possible to start forecasting the scarcity or abundance of the fishery a year ahead. Such information would be a great value to the industry in indicating the extent of preparation needed for the forthcoming season.

3. *Movements and migrations.*—One of the most outstanding characteristics of menhaden is their tendency to congregate into dense schools at the surface at certain times of the year. A second characteristic is the tendency of fish of similar size to school together. Finally, so far as is known, menhaden generally are restricted to the littoral, or coastal, waters inside the 20-fathom contour during the warmer months of the year. Detailed knowledge of these basic features is essential for understanding seasonal and annual changes within populations and their effect on the fishery. Data for following such changes are being obtained routinely from representative sampling of the catch in each locality where purse seine and pound net fisheries are being pursued.

Results of this work have shown a rather consistent pattern in the distribution of the fish. The summer fishery in the Gulf of Maine was supported exclusively by fish 4 years of age and older, while the south Atlantic fishery was based on fish in the first 4 age groups, with the 1-year-olds predominating. Proceeding northward from Cape Hatteras, it is found that progressively older age groups are represented in the various localities. Sampling data further indicate that 1-year-old fish usually school separately, but the largest individuals may join schools of 2-year olds and smaller 3-year olds. Also, size and age distributions of fish in a given locality indicate a tendency for similar size and age groups to occur together, distinct from those of an adjacent, but overlapping locality.

Data available over the past 5 years indicate that in the spring the fish first appear in the pound-net fisheries in Chesapeake Bay and northern New Jersey usually in March or April. Later (April or May) they become available to the purse-seine fishery south of Cape Hatteras and, finally, to the purse-seine fishery north of Cape Hatteras in late May or early June. Detailed data further show that the various size and age groups gradually move northward during the summer, and the fish which contribute to the late summer fishery in a given locality, generally, are smaller and younger in age than those supporting the early summer catches. The 2-, 3-, and four-year-old fish contributed substantially to the catches in May. However, by the end of the summer the smaller 1-year-olds predominated.

A southward migration of spawning fish from northern waters and sexually immature fish from Chesapeake Bay and the middle Atlantic areas takes place in early autumn when they disappear from the fisheries north of Cape Hatteras. They later reappear off the North Carolina coast where they support a sizable fishery in late fall and early winter. The juveniles which emigrate from the estuarine nursery area at that time of year also migrate southward, for they appear for the first time in large numbers in the North Carolina winter fishery.

Slight variations in this generalized pattern of distribution and movements occur from year to year. During the winters of 1952–53 and 1953–54, for example, 1-, 2-, and 3-year-old sexually immature fish and older, sexually mature fish in nonspawning condition apparently did not all move southward, for great numbers were taken in the pound-net and gill-net fisheries off the Maryland and New Jersey coasts. The range of distribution of 1-year-old fish in the fishery also varies slightly from 1 year to the next. This age group may occur in the

northern New Jersey fishery in some years, while in others, it appears no farther northward than Virginia.

From the foregoing it is evident that adequate knowledge of the intra- and inter-seasonal movements of the fish is one of the more important aspects of the problem of fluctuations. Information bearing on this problem routinely is being gathered from many sources, including logbook records kept aboard menhaden purse-seine vessels, records of airplane spotting pilots, interviews with fishermen and samples of catches of various types of fishing gear, such as fyke, pound, and gill nets. A great deal remains to be learned, but sufficient data are being gathered to provide rather detailed knowledge of these features of the fishery.

4. *Spawning and early life history.*—Examination of the gonads of fish sampled from the purse-seine and pound-net fisheries throughout most of the year has furnished information on sex ratio, age and size of sexual maturity, time and place of occurrence of spawning, and reproductive capacity of different age groups. A method for objectively determining the stages of ovarian development has been devised, based on measurements of ova diameters and ovary weight.

Results of these studies indicate that the sexes are about equally distributed in all age groups throughout the range of the fishery. Some individuals are capable of spawning at 2 years of age; however, the bulk of the population reaches sexual maturity in the third year of life. The number of eggs extruded by individual fish varies from roughly 40,000 to about 700,000 depending on the size of the fish.

From data collected over the past 2 years, it appears that spawning takes place over a wide range throughout most of the year. In the northern area some spawning apparently occurs over the entire period during which fish are present in the fishery, but it appears to be heaviest in spring and again in early fall. In the middle Atlantic and Chesapeake Bay areas a similar pattern is suggested. In the southern area, spawning is apparent only in the late fall and early winter when spawning fish from farther northward have moved into the area. From these findings it is concluded that spawning largely occurs from September through May. Commencing in northern waters at the time that a southward movement of the fish takes place in the fall, spawning reaches a peak in southern waters in winter, and continues through late spring when the fish reappear in northern waters.

Plankton sampling conducted over the past 4 years indicates that hatching of eggs and early larval development take place entirely in the ocean. Following absorption of the yolk sac, the larvae enter estuaries and bays and spend the following several months of their life in these nursery areas. Routine collections are being made at several localities along the coast to obtain estimates of relative numbers of larvae entering the nursery areas and the period of entry. At Beaufort, N. C., there is considerable variation in size among those larvae entering in January and February. This may result from differential spawning in the area. However, during the peak of larval recruitment in March and April, a much more uniform size group is evident.

Further studies of the early life of the fish, following their entry to the estuarine nursery areas, are being carried out at our field laboratory located on Indian River, Del. The work is designed to determine (1) growth rate of juveniles within and between estuaries, (2) amount of mixing of juveniles within an estuary, (3) feeding habits and food preferences, (4) responses of estuarine populations to changes in physical and biological factors in the environment, and (5) natural mortality rate.

Results to date show that, following their entry into the estuary, the larvae first appear in the upper limits of the intertidal zone where they congregate in groups of many thousands of individuals. Here they soon undergo metamorphosis into juveniles. During this transformation, the body deepens, scales are laid down, all of the fins become developed, and the fish assume the color of the adults. This transformation commences at a body length of about 33 millimeters (1¼ inches) and is completed at about 43 millimeters (1¾ inches). As the fish increase in size, the schools gradually spread out from the initial intertidal areas and move downstream. It is of interest to note that menhaden have been observed schooling at the smallest sizes encountered in the intertidal areas.

After spending the summer months in the estuaries, the schools congregate in larger bodies in the fall and move out into the ocean. The time of their departure follows roughly the pattern of disappearance of the adults from the

fishing grounds in the ocean, i. e., juveniles leave the northern estuaries earlist. Generally, this emigration commences in early September in northern estuaries and in late September and October in the middle Atlantic region, while in southern estuarines, they may remain throughout the winter and spring months. At the time of their departure from the estuaries, the juveniles may range in size from about 50 to 160 millimeters (2 to 6½ inches) in length, depending on locality.

Two of the more important problems concerned with our estuarine work deal with estimates of the relative size of a year class while it is still in the estuary and the mortality sustained during its stay in those waters. In attacking these problems, we have worked out techniques at Indian River which we plan to extend to certain other areas along the coast.

One method with which we have had initial success consists essentially of marking large numbers of juveniles and estimating the size of the nursery population from the proportion that are recaptured. By this method, an index eventually may be established for estimating the initial success of a year class. The reliability of this method is being tested by comparing this derived estimate with measures of abundance of the year class in the following summer when it enters the commercial fishery as 1-year-olds. The value of the first estimate, of course, is that it would provide a measure of the relative size of a year class before it enters the purse-seine fishery.

Marking individuals also has furnished an estimate of the mortality rate of juveniles in the estuary. It does not, however, cover mortality sustained during the entire estuarine life, but only that over the last 3 or 4 months of their stay. Judging from results of the first year's work, it appears that mortality during this period is low. We presently are working out a technique of estimating total estuarine mortality. The method demands a tremendous amount of effort and is subject to a number of sources of error. Furthermore, it can be applied only in smaller estuaries. However, it could provide the information necessary for determining whether conditions in the estuary are responsible for the size of a year class. Once we know the stages in the life history where the greatest mortality occurs, we can direct attention to those factors which may be responsible.

5. *Growth, recruitment, and mortalities.*—Knowledge of the growth rate of menhaden is important because of its many applications. It is essential to an understanding of the general biology of the fish and fluctuations in the fishery. It further is one of the basic variables which determine the total weight of the menhaden population and the yield from the fishery.

Growth of menhaden has been found to vary a great deal between sexes, between localities, between seasons, and between years. There also is evidence, from the bimodal nature of length-frequency distributions of fish of the same age, that more than one population of fish may be represented.

For estimating the size of the menhaden population we also need to know the amount of increase due to young fish entering the fishery (recruitment) and losses to the fishery due to fishing and natural causes (fishing and natural mortalities). Since we wish to know the relative abundance of the population at the beginning of the purse-seine-fishing season, it is important to know the relative contribution of the 1-year-old fish to the fishery and their fluctuations from year to year. Mention already has been made in the previous section of an estimate of probable recruitment of a year class into the fishery, based on estimates of the size of the population in the nursery areas. Further estimates of the relative size of an incoming year class are being obtained from measurements of its relative abundance in the winter fishery at Beaufort, N. C., and the spring pound-net fishery in Chesapeake Bay. Reliability of these estimates is insufficiently known to permit any conclusions at this time.

A preliminary estimate of total mortality rate has been computed from available age data; however, it will be necessary to accumulate data for a number of years before any reliability can be placed in such estimates.

6. *Measurements of catch.*—It will be recognized that fluctuations in the catch cannot be measured and interpreted without adequate records of the catch from year to year. Such records have been furnished willingly by the menhaden industry.

Our preliminary look at the current condition of the fishery is based on empirical methods, i. e., measurements of total catch, apparent abundance, as determined by catch per unit of effort, and total fishing effort. To date such measurements have been completed for the middle Atlantic fishery from 1939

through 1954. Calculated catch per unit effort (measure of apparent abundance) shows a general upward trend until 1947, followed by a decline until 1951. Subsequently, a marked increase occurred in 1952 and 1953, doubtless due to the impact of the superabundant 1951 year class. Fishing effort increased over the period, reaching a peak in 1954. Similar measurements, together with total catch, are now being completed for other areas by means of automatic-computing-machine methods. A second measurement of apparent abundance is being calculated based on logbook data furnished by the vessel captains and pilots. The two series of measurements will be compared to determine whether they lead to the same conclusions.

7. *Publications resulting from investigations.*—

1956. Variation in meristic characters of young Atlantic menhaden, *Brevoortia tyrannus*. Special symposium on herring races, sponsored by the International Council for the Exploration of the Sea. (In press.)
1956. Biological investigations of Atlantic coast menhaden. Proceedings of the Gulf & Caribbean Fisheries Institute. Ninth annual session. (In press.)

8. *Reports under preparation.*—

1. A bibliography on the biology of North American menhaden.
2. Observations on the sexual maturation and spawning of Atlantic menhaden, based on examination of gonads.
3. Determination of the age of Atlantic menhaden from scales.
4. Use of an inexpensive diagnostic X-ray machine for determining vertebral numbers of fish.
5. Results of Atlantic menhaden investigations, 1952–55.
6. Methods of sampling the Atlantic menhaden fishery.

Commercial shellfish research

SHELLFISH CULTURE IN SALT-WATER PONDS

Observations on gonad development, spawning, and setting of oysters were conducted on Martha's Vineyard Island. Two aspects had to be investigated, i. e., the food requirements of larvae and juvenile mollusks and the salinity range within which existence of larvae and juveniles is possible. In these studies biologists of the Service's Milford, Conn., laboratory cooperated with the Oyster Institute of North America. A number of microorganisms found in natural waters where oysters and clams live was isolated and grown on a large scale to determine their value as foods.

In addition to determining the value of these food forms, studies were made of the growth and survival of young clams and oysters in relation to the number of food cells present in the water. Using the common algae, *Chlorella*, it was found that the optimum concentrations lie between 250,000 and 1 million cells per cubic centimeter. When the number of cells per cubic centimeter was increased to approximately 3 million the rate of growth of juvenile clams was drastically reduced. Still higher concentrations may kill the juvenile clams.

Other studies were made to determine the effect of temperature upon the rate or growth of young clams. Again, optimum temperatures for growth under different ecological conditions were determined.

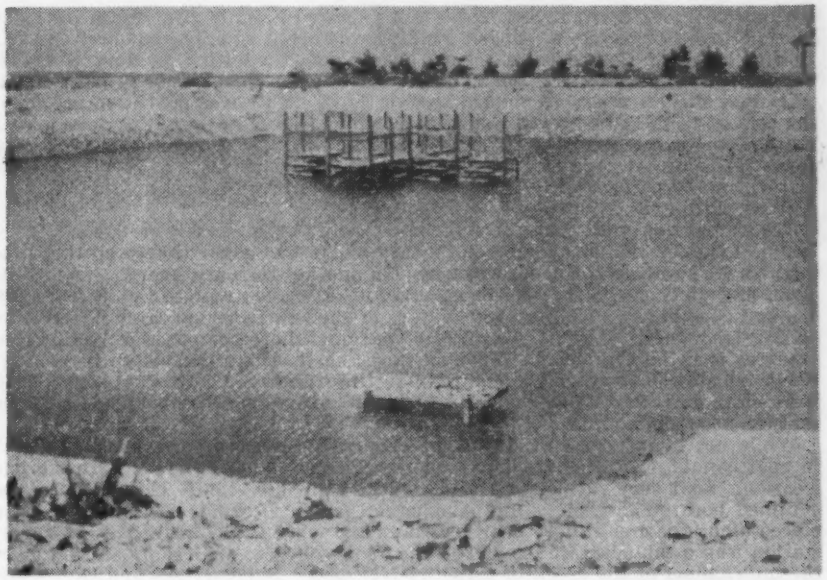
Since many salt water pounds that are available for cultivation of mollusks are often threatened by periods of low salinity, it was necessary to learn more about survival and growth of clam and oyster larvae under different salinity conditions.

The optimum salinity for the development of eggs of Long Island Sound clams (*Venus mercenaria*) was about 27.5 p. p. t. No normal larvae developed at salinities of 17.5 p. p. t. or lower. The upper salinity limit for development of clam eggs appeared to be 35.0 p. p. t. and only an occasional normal larva developed at this salinity. Straight-hinged clam larvae grew reasonably well at 17.5 p. p. t. and many reached metamorphosis, although the optimum salinity for their growth appears to be at least 27.0 p. p. t. At 15.0 p. p. t. none of the larvae reached metamorphosis, although some lived for 10 days or more and showed appreciable growth. At 12.5 p. p. t. straight-hinged clam larvae showed no growth and all were dead by the 8th or 10th day.

The optimum salinity for the development of eggs of the Long Island Sound oyster (*Crassostrea virginica*), that had developed gonads at salinities of 26.0–27.0 p. p. t., was found to be 22.5 p. p. t., although some normal larvae developed in salinities as low as 12.5 p. p. t. and as high as 35.0 p. p. t. The optimum

salinity for growth of larvae of all ages, however, was 17.5 p. p. t., although older oyster larvae grew quite well and set at salinities ranging from 27.0 to 12.5 p. p. t. Growth, even of older oyster larvae, at 10.0 p. p. t. was considerably slower than at 12.5 p. p. t.

The salinity tolerance of eggs and larvae of Maryland oysters, from low salinity areas, was not very different from that of eggs and larvae of Long Island Sound oysters when both groups of parent oysters developed gonads at 26.0–27.0 p. p. t. However, when these Maryland oysters developed gonads in their normal habitat (salinity 8.74 p. p. t. at the time of collection) and were spawned at salinities of 7.5 p. p. t., 10.0 p. p. t. or 15.0 p. p. t., the eggs developed into normal straight-hinged larvae at 10.0 p. p. t. and larvae, normal in shape and only slightly smaller in size, developed at 7.5 p. p. t. Even at 5.0 p. p. t. many of the eggs developed into very early shelled stages before they died. The upper salinity limit for development of normal larvae from these low salinity eggs was also appreciably lower than for eggs from comparable oysters that developed gonads at 26.0–27.0 p. p. t. None of the low salinity eggs developed into normal larvae at salinities above 22.5 p. p. t.



General view of artificial pond used in experiments on propagation of European oysters. Structure in center contains spawning oysters and shells to collect spat. Photograph taken when pond was only partially filled with water.

We do not yet know whether eggs from Long Island Sound oysters, or from oysters in other high salinity areas, would behave in the same manner if conditioned and spawned at similarly low salinities. We also need to know the optimum salinity for subsequent growth of larvae developing to straight-hinged stages at these low salinities. Their requirements may not differ appreciably from larvae developing at higher salinities or they may grow so slowly, at the low salinities they will tolerate, that they will have little probability of reaching metamorphosis.

STUDY OF OYSTER SPAT COLLECTORS

Standard culching practice in the oyster industry consists of broadcasting shells on suitable bottom. Setting potential of the middepth water mass is not utilized commercially on the Atlantic coast, although such utilization has proven commercially feasible in Japan and on the Pacific coast of North America.

Various test surfaces in addition to oyster shells believe to be acceptable to setting oyster larvae were exposed on the bottom and at middepths in two different places in Chesapeake Bay having unlike hydrographic characteristics.

One of these was a protected, shallow depth, slow current, good setting tributary; the other was the opposite to this in these environmental factors.

Test surfaces include coated 2- by 2-inch poles, strings of pierced oyster shells hung on wires and oyster shells in wire bags, resting on the bottom. Some poles were coated with fragmented shells known to poultry farmers as "large grits"; others with concrete. Whole shells in strings were always oriented the same way on each string. Shell bags were filled haphazardly. Some strings were hung with shells the smooth inner face upwards; others with shells the smooth inner face downwards. The coated surfaces of poles and the shell strings were 5 feet long installed vertically from the surface to the bottom at mean low water.

Shells on the bottom in wire bags showed an average of 4 spat per shell at the deep water area and 1 spat per shell in the shallow water area. Commercial culch in the shallow water area also showed an average of 1 spat per shell. In general, this indicated a low setting rate of each of the testing sites. This also reflected the low setting results reported from other parts of the upper Chesapeake Bay.

Middepth studies were made on suspended shell strings and poles coated with concrete and shell grit stuck in the bottom. The low setting rate made conclusive evaluation difficult. Spat setting on poles showed a slight preference for shell grit coatings to concrete coatings. Fouling was about equally abundant on each type of coating. Coated poles did not seem as good a setting medium as shells.

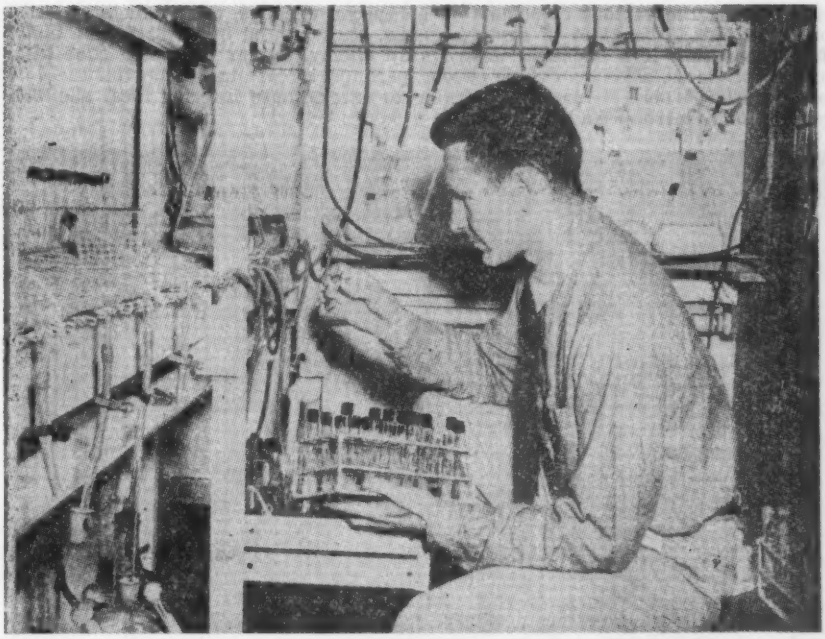
Spat setting was slightly more abundant on lower than on upper portions of poles and shell strings. In the shallow or 5-foot depth area spat occurred from the bottom to the 4-foot level and in the deep or 10-foot area spat occurred from the bottom to the 7-foot level. A spectacular differential setting according to depth zones appeared on suspended shell strings. Measuring up from the bottom better than 50 percent of setting was found within the 1-foot zone, and fully 80 percent within the 2-foot zone.

Tests of setting preferences between cleaned and dirty shells were inconclusive. In one instance the spat count on cleaned shells was eight times the count on dirty shells similarly suspended nearby. In another instance, the spat counts on clean and dirty shells exposed together in bags showed no clear preference for original cleanliness. The physical texture of shell surfaces appeared effective in setting frequency. In strings and bags we found more spat on the rough outer surfaces than on the smooth inner surfaces, shell orientation notwithstanding. Shell orientation appeared a factor in setting frequency. In strings the spat were more numerous on the under shell surfaces than on upper surfaces, surface texture notwithstanding.

While not included for study in our original problem, other trends appeared in spat counts. General setting frequency decreased up the creek with station location. Spat survival decreased also in the same direction. These differences obtained both on test shells and commercial culch. Regular stations had been placed along the creek shore near spawners and within culch plantings. A check station was established at the same time about 200 feet off 1 shore station near the midchannel of the creek in water 11 feet deep. Shell strings and bags were suspended from anchored barrels, the strings reaching from near surface to just scraping the bottom. The bags were lost but three strings survived exposure from July 2 to October 24. Setting counts on these deep-water strings did not duplicate principal findings at the shore station. There was no clear stratification as to spat recovery in depth; they were found from near the surface to about 2 feet from creek bottom. We found as many above the five-foot mark as below it.

In shell condition also the counts disagreed with those from near shore; we found more spat on dirty shells than on those cleaned before exposure. On 2 or 3 strings the shells were oriented with smooth sides uppermost, yet when all counts were combined we found three times as many spat on upper shell surfaces as on the lower ones. Results of our tests and observations at Smith Creek become meaningful when reduced to comparative setting in actual numbers surviving.

Oyster planters prefer that counts in seed stock come to at least 1,000 spat per bushel of year-old seed. This reduced to a minimum count of 200 spat per 100 shells. Our best string (of 7) counted about 65 spat per 100 shells. The best count (in 3 samples) on planted culch was 145 spat per 100 shells. Our best bag (in 3) of 100 shells each counted 285 spat per 100 shells. Our best bag (in 3) of 50 shells each counted 315 spat per 100 shells.



Biologist isolating microscopic organisms from sea water to be later tested as food for molluscan larvae.

We estimate about 1 man-day's work is required to perform any one of the following operations:

Prepare 6 strings: 125 shells each; about 1½ bushels of shells.

Make and fill 30 bags: 100 shells each; 6 bushels of shells.

Make and fill 40 bags: 50 shells each; 4 bushels of shells.

Distribute by hand from a barge on the ground: 150 bushels of shells.

The spring and summer program 1957 under this investigation is a pilot application of the utilization of the middepth zone for seed collection on a streamlined commercial basis. The middepth collectors will be compared in all phases of effort with the regular broadcast system of distributing culch.

CONTROL OF OYSTER PREDATORS, LONG ISLAND SOUND

Several hundred chemical compounds supplied by commercial chemical manufacturers have been tested for their effect on a variety of marine invertebrates, which are predators or competitors of commercial mollusks. Among these forms are oyster drills; crabs; worms of several families, including *Planaceridae*, that kill oysters and eat their meats, and *Polydora* that lives in the oyster shells; tunicates; *Crepidula;* mussels and sponges. The chemicals were used in the following ways:

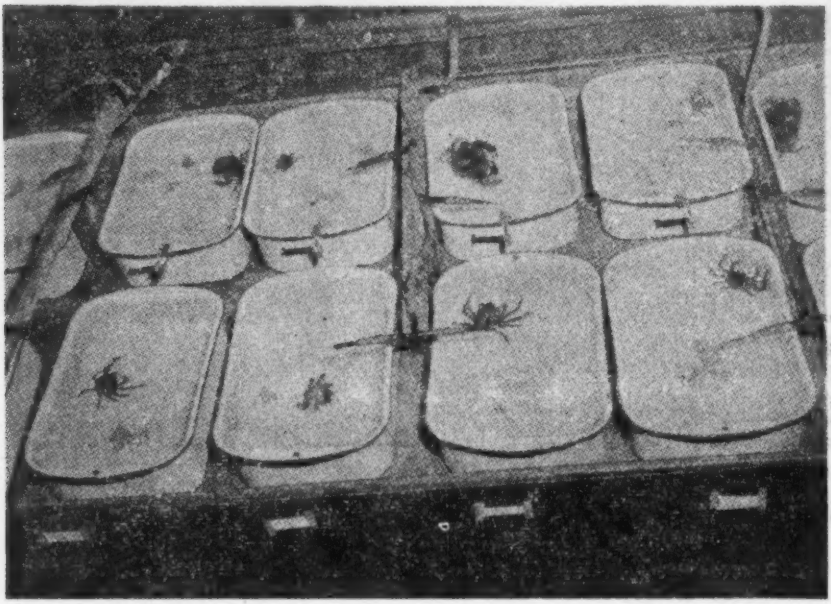
1. Dissolved in water. This approach is practical to kill oyster enemies in small, isolated bodies of water, such as small salt-water ponds, claires, dikes, and large tanks, or for dipping into the solution oysters infested with enemies, such as sponges, worms, barnacles and, perhaps, certain internal parasites.

2. Precipitated as a thin layer on the bottom over the shellfish beds to repel enemies, such as drills, starfish, crabs, etc.

3. Combined with shell material of oysters, rendering it unsuitable for the existence of sponges, worms or other shell-dwelling organisms and, perhaps, even discourage drills from drilling the shells of oysters.

4. Incorporated in food that will be eaten by molluscan enemies, such as horseshoe crabs, crabs, prawns, etc.

In testing the various chemicals on molluscan enemies, their effects are also observed on the behavior of oysters, clams, scallops and other useful animals. It is clear that if a chemical destroys an enemy, but at the same time kills oysters or clams, it is of no value except, perhaps, in certain special instances of pond culture where it may be desirable to exterminate inferior local shellfish population to introduce a better race.



Testing poison baits to kill several species of crabs, which are predators of soft and hard clams. These tests led to development of an efficient and cheap method for control of crabs.

Several compounds were found lethal to drills and many others strongly irritated them. These compounds and others closely related to them are being evaluated as to their practicability and effects on the mollusks themselves. Many other compounds were found lethal to tunicates and worms, while several strongly affected and sometimes killed the dangerous oyster competitor, *Crepidula*, and mussels. Recent experiments, which are still in progress, will probably provide us with a cheap, safe, and effective method for the control of boring sponges of the genus *Cliona*.

Probably the greatest achievement of our work to date has been the finding of several chemical substances that are extremely promising for the control of a large group of direct or indirect shellfish enemies that belong to the phylum Arthropoda, which contains such aquatic forms as crabs, horseshoe crabs, prawns, shrimps, etc. Some of these chemicals were found to be effective in solution in sea water; others, as food poisons; while several could be effectively used either way. To ascertain the effectiveness of some of these substances within the group of marine Arthropoda, we used the following species: rock crab, *cancer irroratus;* blue crab, *callinectes sapidus;* lady crab, *ovalipes ocellatus;* mud crab, *panopeus herbsti;* green crab, *carcinides maenas;* hermit crab, *pagurus pollicaris;* spider crab, *libinia emarginata;* common sand shrimp, *crangon vulgaris;* mantis shrimp, *squilla empusa;* copepods (several species); and horseshoe crab, *limulus polyphemus.* The results showed that all these forms can be quickly paralyzed and killed. Considering the relative positions of these animals within the phylum Arthropoda, we may safely assume that, with few exceptions, we already have a means of controlling most species of this phylum which are harmful to mollusks.

The most striking results have been obtained with some of the chemicals which are used in preparation of such insecticides as Guthion and Dipterex. We have also achieved results by incorporating in the bait other insecticides, such as the

well-known DDT, which we found several years ago to be extremely effective in the control of barnacles and which, since then, has been widely used in oyster culture in Great Britain and other European countries. However, several of these, including DDT, affected only a few species of Arthropoda.

The same or closely related chemicals have been suggested to practical shellfish growers to be used for the control of the following enemies:

1. Many of the true crabs, including green and rock crabs, which are great destroyers of soft and hard clams, *Mya arenaria* and *Venus mercenaria*. We believe that in the near future thir control should pose no problem.

2. The stone crab, *Menippe mercenaria*, is a serious oyster enemy in the Gulf of Mexico where it sometimes kills 25 percent of the oyster set.

3. The mud crab which serves as an intermediate host in transmission of the sporozoan *Nematopsis*, which in many sections of the Atlantic and gulf coasts seriously parasitizes the oysters.

4. The oyster crab, *Pinnotheres ostreum*, living inside oysters and causing damage to oyster gills and otherwise unfavorably affecting oysters, can also be eliminated by using the newly suggested method.

5. The shrimp, *Upogebia pugettensis*, which causes great difficulties to oyster farmers of Puget Sound, can now be cheaply and successfully controlled.

6. A parasitic copepod of the genus *Mytilicola* attacking Olympia oysters can now be successfully controlled.

7. Practically all small crustaceans, until now considered extremely destructive to phytoplankton cultures, can now be safely and quickly eliminated by using solutions of recommended substances, especially TEPP (tetraethyl pyrophosphate). We have been using this method with extreme success to eliminate crustaceans from mass cultures of *Chlorella*.

We are now attempting to develop similar methods for the control of rotifers and ciliates. Some promising substances for control of the latter have already been found.

A new, simple method has been devised which promises to be extremely practical for controlling oyster drills, *U. cinerea*, in many areas. The method consists of burying drills under several inches of bottom material. This is accomplished by using modified types of such devices as agricultural plows or clam or oyster dredges to turn over layers of bottom soil and thus bury the drills. Observations have been conducted to determine how thick a layer of bottom deposit is required, at different temperatures, to suffocate the drills.

A marine fungus infecting the eggs and embyros of the common drill, *Urosalpinx cinerea*, has been discovered and described. This fungus presents another biotic factor which may be of use in the control of the oyster drill, *U. cinerea*. Two new oyster enemies have been found in New England waters, (*a*) the common polyclad worm, *Stylochus ellipticus*, and (*b*) the small snaillike gastropod, *Menestho bisuturalis*.

In cooperation with a chemical manufacturer, we are developing pellets that will contain poisons and substances that should attract crabs, which are enemies of shellfish. These pellets will be mechanically distributed over the ground with a good degree of precision, i. e., one pellet per square foot or whatever concentration is desired. Furthermore, we are seeking specific poisons that will kill one species of crab and not others. For example, we are looking for such a poison that will kill the green crab, which is the greatest destroyer of clams, but will not harm such important commercial species as the blue crab or lobster.

OYSTER DRILL CONTROL, CHESAPEAKE AREA

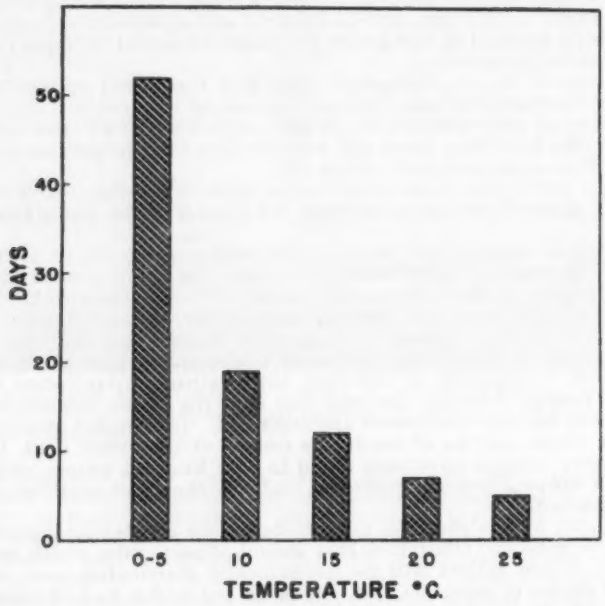
By trapping

Trapping of oyster drills *Urosalpinx cinerea* and *Eupleura caudata* to measure the effectiveness of this method in promoting the survival of young and old oysters is the purpose of these studies. Observations have covered 2 complete seasons of drill activities in 2 areas of different ecological background, 1 in Chincoteague Bay, Md., and Virginia and the other in York River, Va.

1. *Drill trapping in Chincoteague Bay.*—Trapping oyster drills with 40 oyster-bait-filled wire bags per acre removed 100,000 of them from 12 acres in 2 years. The removal of this number of drills was sufficient to permit a survival of approximately 1,200 oyster set per bushel of planted shells in 1956. This is a set of oysters of commercial significance in this area. In 1955, the first summer of these experiments, the planted shells on this plot failed to catch a commercial set of oysters although shells in wire bags held off the bottom caught oyster set at the rate of 500 or more spat per bushel shells. An adjacent plot from

which no drills were removed showed no catch of oysters able to survive either of the seasons of 1955 or 1956. In fact, a line of oyster-baited traps set out in 1956 to test the rate of destruction of bait had every oyster killed by drills in 2 weeks on this plot. Nevertheless, drill trapping at the rate just described, persistently carried out even in the presence of new oyster set, can remove enough oyster drills to save many seed oysters which would not have survived had no control been exercised.

One other factor of significance developed from the trapping program and that is the importance of the current recruitment on the maintenance of the drill population. Unless the young drills of the year are killed or removed, a trapping program is only partly effective. This is illustrated by the trapping results of 1955 and 1956. Until August 20, 1955, the catch records on each of the 3 plots were quite alike but after that time plots 2 and 3 began to show increasing numbers of very small *Urosalpinx* in the catch while plot 1 was lacking in this size group. Small drills constituted 63 percent of catch on plot 3, 51 percent on plot 2, and 29 percent on plot 1.



Number of days needed to cause complete mortality of Long Island Sound oyster drills, *Urosalpinx cinerea*, buried at different temperatures at the depth of 6 centimeters in a mixture of mud and sand. These studies led to development of a cheap but effective method of control of drills, by burying them under thin layers of bottom deposit.

There must be a reason for such a difference in the rates of recruitment on these plots. On plot one a definite step to control the recruitment of young drills was made by immersing all traps in a weak copper sulfate bath at the peak of drill egg case deposition. No such step was taken on plots 2 and 3 in 1955.

All plots in 1955 and 1956 were trapped alike to remove juvenile and adult drills. The copper sulfate method of killing drill embroyos used on plot 1 appeared therefore to be a significant agent for reducing the number of drills contributed by the current hatching. This method of control was proposed and tested by Engle in 1940 and reported to the oyster industry in 1941. (Further Observations on the Oyster Drills of Long Island Sound With Reference to the Chemical Control of Embryos, convention address—National Shellfisheries Association, Atlantic City, N. J. 1941) and confirmed by Newcombe in Virginia (1941–42) and Lindsay and McMillin in Washington (1945, 1949, 1950).

A plot trapped in 1955 yielded 8,000 *Urosalpinx* of which 3,200 were young of the year caught in September. These young of 1955 were the bulk of the early 1956 season catch of drills. All traps were dipped in copper sulfate solution when egg cases appeared during the summer of 1956. At the end of the summer when the current recruitment of young drills would normally appear in great numbers, only 665 were caught or only 20 percent of the number caught the previous year when the plot was not treated.

Another testing of the effectiveness of the copper sulfate dip to kill drill embryos was performed on another plot in 1956. In 1955 a plot receiving the dip treatment at the proper time yielded only 330 young drills or 7 percent of the total catch. In 1956 this same plot was trapped but not dipped and 1,834 young drills or 33 percent of the total catch were caught. A plot undipped in 1955 but dipped in 1956 had the number of small drills drop from 41 percent to 5 percent from June to August.

From a plot trapped each year but not dipped in copper sulfate either year the catch of young drills was 1,150 for 1955 and 1,200 for 1956 or 25.2 and 24.8 percent of the total catch. Trapping at the rate used here appears to be able to hold a population of drills at a certain level but is not very effective in reducing the numbers unless the annual recruitment is reduced at the same time. The combination of the trapping and dipping of traps appears to be effective in controlling drills sufficiently to produce seed oysters.

Oyster seed caught on planted shell on these plots will be protected by these methods during 1957 to determine how many can be brought to harvesting size.

2. *Drill trapping in York River, Va.*—Oyster drills are abundant in lower Chesapeake Bay and its tributaries whose salinities remain under 15 parts per thousand during most of the year. York River is one of these. Wormley Rock, a natural oyster bar in lower York River was chosen to perform trapping experiments because it had drills and supposedly had the stable salinity needed to maintain a drill population. Two areas of 3 acres each were reserved for the drill control experiments. One area was trapped with 93 oyster-baited traps per acre and the other untrapped. Clean shell was planted on each area in the spring of 1955.

The results of these protection experiments are as follows:

1955: On planted shells 75 percent of total oyster set survived the first season on trapped area while 53 percent survived on untrapped area; 5.9 percent of spat were drilled on trapped area while 23.4 percent were drilled on untrapped area.

1956: On planted shell 80 percent of total oyster set survived on trapped area while 62 percent survived on untrapped area; 5.8 percent of oyster spat were drilled on trapped area while 19.0 percent of oyster spat were drilled on untrapped area.

Drills were much less numerous on these beds than in the Chincoteague Bay beds which accounts for a moderately good survival of the spatfall even on the untrapped area. The observations on trapping did show that the removal of oyster drills at the rate possible with 93 traps per acre helped save 20–25 percent of the oyster set of the 2 years under observation.

Conditions in this area were radically changed by freshets following a hurricane and the natural population of drills reduced by lowered salinity, a most effective control. In order to continue the study on the value of trapping as a drill-control method, the operation in lower York River was terminated at that spot May 1, 1957, and transferred to Chincoteague Bay to increase the effort there and consolidate the project where drills and oysters were more abundant.

Drill trapping is being continued in 1957 at Chincoteague Bay, Md. and Va. One phase is the protection of oyster seed collected on planted shells during 1956. The other phase is replication experiments to test the validity of the results of several methods of control used by industry which were reexamined by the USFWS staff.

Oyster drill control by copper fencing

The discovery made in the laboratory at Boothbay Harbor that ions from metallic copper repel oyster drills was described in the annual report for fiscal year 1956. Field trials in Maine during the summer of 1956 using the mud snail *Nassa* and in Maryland and Virginia using the oyster drill, *Urosalpinx* have confirmed laboratory results.

In the first 40 days, 593 *Urosalpinx* entered the control area in an experiment at Chincoteague Bay, Va., which was fenced with a galvanized iron hardware cloth fence 4 inches high. During the same period only 14 *Urosalpinx* were found inside of the enclosure fenced by a brass screen of the same height and

two of these were believed to have crawled under the fence through a hole dug by crabs. Only two *Urosalpinx* were found inside of a third experimental area which is surrounded by a plastic screen fence which had a ¾-inch-wide copper strip around the outside. Both of these drills were believed to have crawled under the fence when one corner was washed clear of the bottom by wave action.

At the end of 110 days the mortality of oysters caused by drills inside of the control area was 30.8 percent. During the same period the mortality of oysters inside the experimental area fenced with brass screen was 0.8 percent. The experimental area fenced with plastic screen and a copper strip was washed out by a storm before the end of the experiment after the plastic screen had become fouled. It has since been discovered that copper paint will bond to this Saran plastic screening and probably can be used to retard fouling.

There was no indication of less setting or greater mortality of oysters which might have been caused by copper in the two experimental plots as compared with the control.

The brass screen fence has remained in place in the intertidal zone for a period of 1 year but is now less effective in repelling drills than it was last summer. This experiment will be continued to determine the maximum time which a brass screen fence can be used under the severe conditions of the intertidal zone.

One of the limitations of copper barriers is that oysters immediately adjacent to the fence may be discolored a bluish-green by the dissolved copper. In the Chincoteague Bay experiment during the summer of 1956, 92 percent of the oysters within 18 inches of the 4-inch brass screen were greenish after a period of 4 months. Only 8 percent of the oysters within 18 inches of the plastic and copper fence were greenish at the end of this period and none of the oysters in the control plot were green. Later fence designs used smaller quantities of copper to reduce discoloration of oysters as well as cost.

A small fence made of chain, Saran plastic screen, styrofoam floats and utilizing a 1-inch strip of copper screen as a chemical barrier was tested in the laboratory. This fence resembles a miniature seine with the chain as the lead line and the styrofoam floats holding the screen erect. The copper screen is placed horizontally along the outside of the fence approximately one-third of the way down from the top. The height of this fence is approximately 6½ inches and it is hoped that its flexibility and ease of construction and installation will make it economical to use since tests in the laboratory and in a tidal area have indicated that the fence is effective in design and as a barrier. Field tests using one-hundredth-acre plots were set up at Bogues Bay, Va., during June 1957 to test the flexible barrier and to compare it with the designs used last year.

In line with the work on copper barriers, 9 green antifouling paints were tested at the Boothbay Harbor, Maine, laboratory for effectiveness as barriers for drills. Eight of these paints proved to be effective barriers to oyster drills, *Urosalpinx* and *Eupleura* in laboratory experiments. Field experiments are now being set up at Bogues Bay, Va., to test the effectiveness of several of these paints under natural conditions. If any of these paints are effective in the field it should be possible to reduce the cost of fences greatly.

Oyster drill control by suction dredging

Design and function of a small oyster drill suction dredge.—Trapping methods for drill control are usable only when they can be applied in shallow water not having heavy boat traffic. To meet the condition where trapping would not work, for example, the open waters of lower Chesapeake Bay, a drill dredge with suction cleaning device was developed under this program. Tests of efficiency and modifications to eliminate the several defects were in progress this year.

The small scale model now being tested removes drills from the bottom at the rate of 800 per hour when a drill population is 25,000 per acre. The drill dredge at this rate can remove in a 10-hour day about the same number of drills as 93 traps tended weekly can remove in a season. This is speculation based on limited dredge information but encouraging because trapping at this rate can remove enough drills to permit a better survival of oyster spat than was found on an untrapped area.

The drill dredge in tests in 1956 showed a maximum efficiency of 15 percent. To examine the gear while in operation, aqualung divers observed the action of the dredge on the bottom at several towing speeds. As the speed increased the dredge was inclined to jump or bounce. When the towing speed was reduced to two knots or less, the cutting blade had a tendency to pile up bottom material

in a rolling heap ahead of it, and only a small amount passed over the collecting screen of the dredge.

To maintain a constant movement of bottom material over the collecting screen a towing rate of three knots was needed. At that rate, however, the dredge did not keep a constant contact with the bottom. To overcome this condition, diving plates were designed and attached ahead of the cutting blade. The efficiency of the dredge was increased by 3 percent by this addition.

When cold weather arrives the tests will be continued. This is the time to dredge because the drills are less active and cling less tenaciously to the bottom debris.

BIOLOGY OF GULF OF MEXICO OYSTER DRILL

Study of oysters and predators in Apalachicola Bay, Fla. (contract with Florida State University)

This report covers the second year (June 1956–May 1957) of the study of oysters in the Apalachicola Bay, Fla. The first year of study (June 1955–May 1956) was devoted to an ecological survey of three oyster reefs. The second year of the study was devoted primarily to an intensive study of one oyster reef, St. Vincents Bar. The other stations were sampled on a seasonal schedule. St. Vincents Bar, according to reports, had previously been a producing reef. At the present time, no market oysters are produced on this reef, although there has been a heavy attachment of spat during 1955 and 1956.

The study of St. Vincents Bar consisted of a comparison of the natural bottom with what was, in effect, an experimental bottom. The experimental bottom was created by placing a 12-liter bucket of bottom material, picked free of the known predators, inside a basket made of ½-inch-mesh hardware cloth. Twenty-four such baskets, measuring 9 by 26 by 51 centimeters, were prepared and secured to the bottom. The procedure was to remove two of these baskets each month to the laboratory for detailed analysis. A control sample of 1 meter square of natural bottom was collected by taking 4 random samples from a ¼-meter square frame sunk to the bottom.

Laboratory analysis was similar to that made on the quantitative samples during the first year of study. All oysters for a representative sample were examined for mortality and measured for size. Quantitative counts were made, if possible, of the associated organisms. Hydrographic sampling for temperature, salinity, and turbidity were taken concurrently.

The other two stations, Indian Lagoon and reef north of bridge, were sampled in the same manner as was done during the first year of study.

The results have not been completely analyzed as yet. At the present time, a final report of the 2-year study is being prepared. Some of the more striking results, however, are given.

It appears that the oysters and the ecological conditions from the station in India Lagoon were very similar to what was found during the first year of study. Conditions in Apalachicola Bay proper differed. This was especially noticeable on St. Vincents Bar. During the previous year, the salinity over this area remained fairly high. As a result, there was a rather dense population of the southern oyster drill, *Thais haemastoma*, and approximately half of the newly attached oysters, during the season of 1956, were of species *Ostrea equestris*. This species cannot tolerate the lower salinities in which *Crassostrea virginica* are commonly found. *Ostrea equestris* decreased in percentage in the baskets to about one-quarter by January of 1957. During April and May of 1957, there was a drastic decrease in salinity and, when the baskets were sampled May 11, 1957, no live *Ostrea equestris* were found.

The oysters that attached to the bottom material protected by the hardware-cloth baskets had a much higher survival than those on the natural bottom. Thus, in the baskets, some of the oysters that attached during the summer of 1956 had reached the size of 3 inches in length by the middle of May 1957. No oysters over about 1½ inches in length were found on the natural bottom. The oysters in the baskets were protected from the oyster drill and, hence, it can be concluded that the drill was the causative agent that prevented oysters on St. Vincents Reef from obtaining market size.

The low salinity, if it persists, found in May 1957 will be intolerable for the continuation of the existence of the oyster drill and, hence, there is a possibility that this reef may again produce market oysters.

During the summer of 1956, an experiment was run in which oysters were taken from the station above the bridge. These oysters were placed in hard-

ware-cloth baskets to protect them from the predation by the drill. Despite the protection, the oysters showed a very high mortality, and a preliminary analysis indicates that the pathogenic fungus, *Dermocystidium marinum*, was present in the transplanted oysters and caused the deaths.

Local environmental factors affecting gulf oysters

A precise knowledge of the basic factors contributing to the superior quality of shellfish grown in certain areas would be of fundamental importance, both to the oyster industry and to the biologist. Oyster growers have long recognized that particular bays or water bottoms may produce oysters noteworthy in some special manner. Place-named oysters, such as Blue Points or Bayou Cooks, have had a well-deserved reputation for this reason.

In the course of several years of observations on shellfish growth near Pensacola, we found repeatedly that oyster growth differed significantly at two stations near our laboratory. These two stations, designated east and west, appeared to be similar in most respects and were only 1,000 feet apart. This provided an unusual opportunity to undertake a continuing study which might reveal important environmental factors not discernible by short surveys or spot-check investigations. With such knowledge, it might be possible for the shellfish culturist to improve the quality or quantity of production from controlled areas.

A program was put into effect in March 1956 designed to demonstrate, first, the specific effect of these two environments on the growth of oysters and clams, and, second, to identify or isolate those factors responsible for the observed growth differences.

Certain avenues of investigation appeared to be more useful than others in conducting this study. Since growth differences in test animals were the most obvious end result of these two environments, we decided to determine the amount of food available for shellfish. Clams and oysters are filter feeders, removing their food from the plankton; consequently, their food cannot be readily isolated and identified as such. However, an estimate of plankton abundance can be made by measuring the amounts of phytoplankton pigments present. This can be considered an indirect measure of the amount of food available for shellfish. It was necessary, also, to have a record of the hydrographic features of the two environments. An equally important requirement for the study, we believed, was to have a reasonably continuous record of these different parameters of the environment to reveal the tidal and seasonal fluctuations over a considerable period of time.

The first progress in the investigation was achieved with the construction of semiautomatic water samplers which collected at a slow but continuous rate a very small amount of water at each station. These samples accumulated and could be analyzed at any convenient time interval. We then established, at each station, trays of experimental hard clams and oysters which, initially, were as nearly similar as possible. During the succeeding 15 months, we have obtained a nearly continuous record of hydrographic changes and the amounts of plankton pigments occurring in the water at the 2 stations. We have also recorded the bimonthly increments in growth of the test clams and oysters, as well as certain other animals which settled fortuitously in our trays.

It is of interest to examine briefly the preliminary results. The data show that these two stations are in a typical estuarine environment. Salt content of the water, temperature, and plankton abundance vary with the tides and seasonally. We have found no identifiable factor which distinguishes this area from many other average oyster-growing regions.

Our earlier observation that growth rates are faster at the east station have been confirmed. This is shown most dramatically by a small noncommercial clam called Morton's cockle which set naturally in the protected experimental trays. These clams attained maturity in the 2-month periods between our measurements. Typically, the cockles at the east station gained an average of 200 percent more weight than cockles at the west station and, incidentally, outnumbered the cockles at the west station by 10 to 1.

New England hard clams grown at the east station gained approximately 60 percent more in weight than those at the west station in the 15-month period. From the commercial point of view this means that, for each pound of seed clams planted, those at the west station would have increased to 7.6 pounds while those at the east station increased in total weight to 12 pounds during the same period of time. This growth differential is shown in the figures where shells representing the smallest, the median, and the largest clams and cockles from the east and west stations are presented.

The increased growth in oysters is less striking but would still be important commercially. There was a weight differential of almost 20 percent in the 2 groups at the end of the test period. In handling the test animals routinely, we noted that barnacles and other fouling organisms were typically more numerous, also, at the east station. Our data further show that this growth differential is a continuing difference in the two environments, and not just present sporadically or seasonally.

In view of this biological evidence for the existence of 2 dissimilar environments, our chemical and physical data acquire considerable importance, even though they do not help differentiate the 2 environments. To date, our sample analyses and other physical records have shown no obviously significant difference at the two stations. Our records include values for water temperature, salinity, turbidity, five plankton pigments, and nutrient-salt concentrations. Each one of these items could be a limiting factor in an environment, and, therefore, they are among those which biologists examine first in determining the suitability of a given body of water for shellfish culture. The fact that we have characteristically different growth rates under comparable physical conditions shows that we are dealing with some relatively subtle factor which may be decisive in creating a superior environment.

We believe that this item is a trace element essential to nutrition, perhaps some substance that acts as a threshold or trigger in regulating feeding activity or, perhaps something even more obscure. Since it has its effect on widely divergent groups, such as oysters and barnacles, it is of widespread significance.

Economic loss due to gulf oyster drill

This project was undertaken at the request of the Gulf States Marine Fisheries Commission and the oyster industry. Only limited knowledge exists regarding the relationship of oyster drills to the oyster industry of the Gulf of Mexico. Because the oyster drill is one of the factors held responsible for the present low oyster harvest in many areas, we must know its economic importance before remedial measures to increase oyster production can be properly undertaken. Knowledge of the relationship between the oyster drill and oyster industry provides a basis for the proper allocation of funds for drill-control measures.

The specific objectives of this investigation, therefore, were to determine in each of the Gulf Coast States:

1. The distribution of oyster drills.
2. The economic importance of oyster drills.
3. The potential for oyster culture.

In order to secure such information, it is necessary to determine the amount and condition of reef bottoms, as well as the location of barren bottoms suitable for oyster culture.

This project, which is, in reality, a survey, follows three main lines of investigation: (1) A review of literature and records; (2) interview with qualified persons; and (3) the physical inspection of the marine bottoms along the entire gulf coast where there is a possibility for oyster culture. When necessary, experimental studies are conducted to determine the loss of oysters from drill predation.

In the past fiscal year, the survey data for Mississippi were prepared and revised for publication. Experimental studies designed to show the losses of oysters from drill predation in Mississippi were completed and incorporated in this report. The survey is continuing in Florida and is divided into two divisions: (1) Northwest Florida; and (2) the southern peninsula. In northwest Florida, we have surveyed over two-thirds (190 miles) of the coastline. This part of Florida is scheduled for completion this summer (1957). In southern Florida, we have surveyed approximately half (180 miles) of the coastline. This area is scheduled for completion during the fall and winter of 1957. The reports for these two sections will be published upon completion of the survey.

Mississippi survey.—This survey shows that of 390,000 acres of water bottom in Mississippi approximately 20,000 acres are suitable for oyster culture, with only 22 percent now in production. The oyster drill was found on 90 percent of all water bottoms, including 80 percent of the oyster-reef bottoms. Production from these reefs in 1956 was 150,000 bushels, but has been as low as 6,000 bushels. This severe condition was brought about by drought conditions, resulting in high-salinity waters favorable for oyster drills. During average or normal years, when rainfall is sufficient to keep salinities at lower levels, the drill inhabits from 70 to 80 percent of the total water bottoms, but only about 25 percent of the oyster-reef bottoms. Under these conditions, Mississippi produces from one-half to 1 million bushels of oysters annually.

Normally, the major oyster-reef complex in Mississippi has about 7,500 acres in oyster production. Four thousand acres are now depleted, and the cultch reduced to such an extent that the oyster drill is capable of destroying the annual spatfall. In 1956, the producing bottom had decreased to 3,500 acres, of which 2,000 acres produced very few oysters and are fast approaching depletion. The remaining 1,500 acres, while supplying a large percentage of the oyster harvest, are producing at a reduced level.

Our survey disclosed that in 4 months, from August to December 1956, oyster drills destroyed half of the oysters on 80 percent of the productive reefs. Drills also destroyed 40 percent of the 1956 spatfall on these same reefs. The 1956 spatfall represented a potential harvest of over 1 million bushels. However, with the present high predation rate this future potential crop will be reduced to less than 100,000 bushels.

On the basis of these predation figures and the 1956 production, we estimated that when high salinity conditions occur the oyster drill destroys over one-half million bushels of oysters annually and prevents 4,000 acres of depleted oyster reef from returning to commercial production. However, there is more bottom suitable for expansion of the oyster industry into relatively drill-free areas than reef bottoms in the entire State. A small oyster harvest can be expected in Mississippi until (1) environmental conditions change for the better, or (2) an economical control measure is found for the oyster drill, or (3) the oyster industry is expanded into relatively drill-free areas.

Northwest Florida survey.—There are 18 well defined bays along 300 miles of coastline containing over one-half million acres of water bottoms. Three hundred and fifty thousand acres have been surveyed, 225,000 acres in the past year. This includes the water bottoms from St. Marks (our division point between northwest and southern Florida) west through St. Vincent's Sound including Apalachicola Bay, the center of Florida's oyster industry. High salinity waters occupy over 90 percent of this area.

The oyster drill, *Thais haemastoma*, and the crown snail, *Melongena corona*, another oyster predator, were found in high salinity waters throughout this area. Population densities of *Thais* were much heavier in the western section. Another oyster drill, *Urosalpinx perrugata*, was found in high salinity waters throughout most of this area but generally was most numerous in the eastern two-thirds.

Most of the reef bottoms located in high salinity waters are either commercially depleted or are 'coon reefs. Oysters from 'coon reefs are usually unfit for commercial harvest because they are clustered with deformed shells. 'Coon oysters when separated do supply seed oysters suitable for transplanting to better growing areas. Snail predators cause considerable oyster mortality on these 'coon reefs and are an important factor preventing many depleted reefs from returning to commercial production by destroying the spatfall. Periodic invasions of drills occur on some of the producing oyster reefs when drought conditions result in increased salinities. All reefs now producing large quantities of oysters are located in relatively drill-free areas. Suitable bottom is available for expansion of the oyster industry in these areas.

Southern Florida survey.—We have surveyed two sections of coastline in southern Florida; 140 miles from St. Marks south through Homosassa River and 50 miles from Cortez to Placida. Seventy miles of coastline from St. Marks south has a relatively straight shoreline. The next 70 miles south contains hundreds of islands and 'coon oyster reefs. The area from Cortez to Placida is characterized by shollow, narrow waterways. The State Board of Health has closed several areas to oystering because of pollution.

High salinity waters predominate throughout the areas surveyed in southern Florida and predatory snails are very numerous. However, the southern oyster drill, *Thais haemastoma*, was not found south of St. Marks River, which can be considered the eastermost limit of its range in the gulf as an important oyster predator. Several other species of snails were found causing oyster mortality on 'coon reefs and destroying spat on depleted reefs. The most important of these were the crown snail, *Melongena corona*, and the oyster drill, *Urosalpinx perrugata*. *Melongena* was most numerous on the inshore reefs and *Urosalpinx* offshore. Another snail causing oyster mortality but more restricted in range was the lace murex, *Murex florifer*. The banded tulip, *Fasciolaria hunteria*, the true tulip, *Fasciolaria tulipa*, the lightning whelk, *Busycon contrarium*, and the Florida horse conch, *Pleuropoca gigantea*, probably are oyster predators but usually are not numerous enough to cause much damage. Another small snail, *Aplus tinctus*, was present in large numbers on many of the 'coon reefs. Its role as an oyster predator was not determined.

The commercial harvest of oysters in the areas surveyed in southern Florida is restricted to a small area in the vicinity of Crystal River and Suwannee River. Thousands of 'coon oyster reefs throughout this coastline supply a small harvest for local consumption. The major importance of these 'coon reefs is their potential for production of seed oysters. Bottom suitable for oyster culture was found in relatively drill-free areas near the mouth of Suwannee River.

On the basis of the portion of the survey completed and analysis of results, we believe that many areas exist that are suitable for expansion of the oyster industry, provided an economical method of drill control can be found.

Study of biological control of drills

In the search for methods of controlling oyster predators, such as the drill, and probably harmful commensals, such as the boring clam and sponge, we are guided by our need for something inexpensive and not likely to be subject to the vegaries of the elements.

The initial step to develop pest controls, then, was to establish all of the pertinent facts in the life cycles of the predators. In the course of these studies on the drill and the boring claim, *Martesia*, certain unidentified microscopic parasites were found. In one instance, they were observed to invade the gonad of the host, destroying the tissue and causing what is known as biological castration. Such a parasite is useful to man, for if the numbers of the parasite can be sufficiently increased in nature, the reproductive potential of the oyster predator should be seriously reduced with resulting benefit to the oyster harvest.

As a result of this thinking, this project was activated in June, 1956, with the following objectives:

1. To conduct a survey to determine the parasites and commensals of the drill and boring clam;
2. To identify those parasites which cause severe damage to these oyster predators;
3. To work out the details of the life cycles of the most promising of these parasites and to determine their effect on the host animal; and
4. To determine whether the numbers of any of these parasites can be increased to the point where they will be detrimental to the drill and boring clam populations.

During the past year, our work has been concentrated on the drill. In our survey for parasites and commensals, we have examined 1,635 drills from Grand Isle, La., Biloxi and Gulfport, Miss., and Pensacola and Apalachicola, Fla. We expect to examine several thousand more drills from Texas, Louisiana, and Florida this summer when we receive them from collectors in the field.

To date, the following forms have been noted, some of them without prior record: flatworms common in the mantel cavities of most of the drills examined to date; larval tapeworms and larval threadworms have been found in parts of the digestive tract; a small crab has been collected from the mantle cavity of a drill from Mississippi; the boring clam is frequently found in the shells of drills from Biloxi and Gulfport, Miss.; and developmental stages of two species of flukes have been found in the digestive glands of snails from Biloxi and Gulfport, Miss., Grane Isle, La., and Pensacola, Fla. The first of these flukes was found in September, 1956, and all stages in its life cycle have been studied thoroughly in drills from Mississippi and Pensacola. The second was discovered in June, 1957, in the digestive gland of a single drill from Biloxi, Miss. The digestive gland and larvae have been preserved for further study and identification.

In September 1956,, the livers of several drills from Gulfport, Miss., were found to be heavily infected with larval flukes. Subsequently, this worm was found in the livers of drills from Biloxi, Miss., Grand Isle, La., and Pensacola, Fla. About 2.5 percent of the drills we have examined to date have been massively infected with this parasite. No attempt was made to determine light infections.

The larvae invade the liver and, in massive infections, also the reproductive organ. In nearly all of the natural infections we have seen, from 60 to 90 percent of the liver tissue was replaced by the developing larvae of this parasite. Since there can be little doubt that such severe damage could alter the activity of the host snail, we consider this parasite worthy of further study as a possible means of controlling drill populations.

Having learned from the literature that the herring gull is the intermediate host, we began collecting and examining gulls last January. After considerable initial difficulty both in capturing and keeping the gulls alive, we were able to establish a small gull colony. Infections have been induced experimentally in

both herring and ring-billed gulls and all stages in the life cycle of this parasitic worm have been studied. We are now using the gull colony to provide infective stages of the parasite for study of the resistance of drills to infections. On successful completion of this study it will be possible to (1) increase the incidence of infection in wild populations of gulls and oyster drills, (2) reduce the size of drill populations as a result of the infection, and (3) increase the number of oysters available for harvest.

PACIFIC OCEANIC FISHERIES INVESTIGATIONS

NORTH PACIFIC ALBACORE RESEARCH

The third year of albacore investigations in the north Pacific under the Saltonstall-Kennedy Act has been completed. The keynote of these investigations has been the coordination of efforts with those of other interested government agencies through the albacore steering committee of the Pacific Marine Fisheries Commission. This committee has been particularly effective in facilitating integration of field work and in making most efficient use of the available vessels and personnel.

Albacore distribution

Studies were primarily oriented toward (1) napping the early summer distribution of albacore; (2) further defining the concentrations of albacore lying in a band between Hawaii and the Aleutians during the summer; and (3) surveying the fall distribution of albacore from approximately 145° west eastward to the Pacific coast. Primary emphasis during the year was given to gill netting and surface trolling, both of which have been shown to catch albacore effectively.

During the summer the *Manning* took albacore in a narrow zone between 175° West and 145° West east of 145° West, the *John N. Cobb* conducted surveys from there to the coast, capturing widely scattered albacore. As is well known by now, commercial fishermen following up these catches, and in part guided by the successful fishing of the *Manning* off the coast during the summer of 1955, moved offshore and located albacore in commercial quantities. Thus there developed the first sizeable albacore landings off the Oregon coast in several years.

Returning to the *Manning* and her survey between Hawaii and Alaska, she took large numbers of albacore from the most western leg of her survey (175° West) by gill net and trolling and that the region of high abundance extended as far east as 160° West longitude. From this point to 145° West longitude, abundance progressively decreased. During the first part of the survey along 175° West, albacore were most abundant between 41° North and 46° North, with centers of abundance around 43° North and 45° North. The second portion of the surpey, the eastward trolling and gill-net leg, yielded relatively abundant catches somewhat farther north.

The *Manning* caught a total of 602 fish, representing approximately 4½ tons of albacore. Of these, 451 were taken in gill nets, 104 on troll lines, and 47 in trammel nets. The fish ranged in weight from 7 pounds to 30 pounds. Particularly noteworthy is the large catch by gill net, despite the fact that the 12 shackles were not all of suitable mesh size for optimum catch. High catches such as these, made on small amounts of gear, suggest that there are commercial possibilities in this area. These possibilities are enhanced by the proximity of Aleutian bases for logistic support and the fact that the area is readily available to halibut fishermen who have experience with fishing conditions in this general area.

Despite the fact that trolling was conducted from dawn to dusk of each day it produced fewer albacore than gill netting. However, the catches in general verified the centers of abundance as revealed by the gill nets.

It is believed that the success during this summer cruise was at least in part the result of an exceedingly shallow thermocline in this region. During some days the layer of warm surface water in which the albacore live was so shallow that the ship's propeller brought up the deeper, colder water. Under such environmental conditions we suspect that the albacore are restricted to a thin surface layer of water and are particularly vulnerable to gill nets. Some of the evidence for this belief lies in the observation that following a storm, which deepened the thermocline, the gill-net catches dropped off. Later, during the fall surveys, when the thermocline was about 200 feet below the surface, the gill net did not catch appreciable numbers of albacore.

The fall surveys by the *Manning* and *Gilbert* were designed to describe the distribution of albacore between Hawaii and the west coast at a time when the coastal fishery was diminishing. Trolling was conducted throughout both cruises.

Whenever weather permited, gill nets were set at night. If the weather was too bad for gill netting, the vessels either jogged or reduced their speed at night to avoid large gaps in the trolling coverage.

Albacore were taken in significant numbers over a wide area extending from the western border of the survey to the coast a few miles north of San Francisco. The results are particularly gratifying because the distribution of albacore can be rather logically associated with the distribution of environmental properties. All catches were made in an area with well-defined limits. To the north and east catches were confined by the 57° surface isotherm. The southern limit was the northern boundary of the barren, blue, central, northeastern Pacific water as indicated on the chart. This boundary could be readily determined from the bathythermograph (temperature) sections and also from the clarity of the water.

In the barren central water the color was an intense blue, and the Secchi disk (a device for measuring transparency of the water) could be seen to a depth of 18 fathoms. In the more productive transition zone where albacore were caught the transparency as measured by the Secchi disk was reduced to 10 or 12 fathoms and the color became blue-green. In the coastal water, which did not contain albacore, the Secchi disk could be seen only to depths of 7 to 9 fathoms and the color was green.

The fall distribution of albacore extending from the coast to well offshore in a fairly continuous band, suggests that a migration away from the coast is taking place and that it is a gradual exodus rather than a rapid, purposeful migration as may have occurred when the albacore were approaching the coast in the spring.

Analysis of data collected since the start of the program in 1954 has enabled the postulation of a general hypothesis concerning the migration of albacore in the North Pacific. In the spring, these fish perform a rapid and purposeful migration from midocean to the coast of California. During the summer, the migration continues with the route gradually shifting to the north. At the time the albacore now in the coastal waters also tend to move northward following optimum temperature conditions. Toward late summer the migration toward the coast ceases and there is a gap in the oceanic distribution from about 140° W. to 160° W. longitude at about 45° N. latitude. This gap coincides in time with the formation of the well-developed thermocline in the central North Pacific and the associated high concentrations of surface albacore. In the eastern North Pacific the albacore are scattered along the entire west coast of the United States. During the fall they undertake a gradual westerly movement away from the coast bridging the gap and ultimately appearing in the Japanese winter fishery. This hypothesis is partly confirmed from tagging results.

In the future field studies will be largely in the areas which have shown commercial promise. Surveys will be continued to ascertain the migration routes into these areas and the oceanographic and biological parameters which govern these movements. Within the areas emphasis will be on the microdistribution and ecology of the albacore.

The northeastern Pacific albacore survey (NEPAS), a concentrated survey of the waters off northern California, Oregon, and Washington during the current summer marks the beginning of such studies. The *Manning* has already begun a survey of the offshore waters and will be joined by the *Smith*. In addition 9 commercial vessels will be utilized in late July and early August to make a concentrated fishing survey of a band approximately 350 miles wide off the coast between Point Arguello, Calif., and Grays Harbor, Wash. During this phase of the survey the *Smith* and the *Manning* will patrol the area collecting detailed oceanographic and biological data to attempt to determine the conditions which govern the occurrence and movement of the albacore.

Four albacore tag recoveries have been reported all of them rather long term, the period of release ranging from 259 to 471 days. All 4 fish were tagged in midocean; 3 were recovered off the coast of Japan and one was recovered in California coastal waters. The recoveries give considerable support to the contention that there is only one albacore population in the North Pacific. In particular, we note two recoveries from fish tagged in 1955. Although they were released within a few miles of each other, one was recaptured by a Japanese live-bait vessel about a thousand miles off Japan on June 24, 1956, and another was recovered off Baja California on August 1, 1956. The 2 recoveries were made about 5 weeks apart; the distance between the points of recovery is about 4,350 miles. These returns may not seem to be strictly in accord with our hypothesis of migration but their interpretation depends on an unknown factor—their movements in the interval between tagging and recovery.

In attempting to tag albacore over the entire North Pacific, two biologists were sent to Japan to conduct tagging and to instruct Japanese technicians in tagging methods. The Japanese showed great interest in this work, and with their help we were able to tag 270 albacore. As a result of this motivation the Japanese have initiated a tagging program in their 1957 albacore live bait fishery with a goal of 1,500 releases. However, we have no data on the success of this program to date.

Spawning and maturity

Examination of all ovary samples collected in the north and equatorial Pacific has been completed. There is no evidence of albacore spawning in the temperate waters in which the Japanese coastal and American coastal fisheries are conducted or in the temperate waters north of Hawaii. In these three areas all the fish taken have been either sexually immature or, in the case of the larger winter-caught fish, there is no evidence of ovary development.

Good evidence has been found of albacore spawning in the subtropical Hawaiian waters and those of the south of the Equator. In these areas the small, immature albacore so typical of the temperate waters have not been found.

From the above it is hypothesized that albacore are spawned in subtropical or tropical waters. During their second year of life they migrate to feeding grounds in temperate waters where they remain for 2 or more years. Following this they return to the tropics to spawn. Thus an adequate understanding of the albacore fisheries may involve studies of the albacore population and its environment which encompasses the waters of the Pacific Ocean extending from 50° N. to well south of the Equator.

Analysis of the landing records from the tuna cannery in American Samoa shows considerable albacore are now landed each month from the area ranging from the Equator south to 28° S. latitude between longitudes 160° W. and 180°. These landings offer an opportunity to determine whether or not and at what season they spawn in this area and arrangements are being made to get a sampling program underway in Samoa.

Age and growth

Albacore growth studies based on hard parts have forced us to conclude that it is not possible to age albacore from their scales or their bones for the following reasons: (1) the rings found on the scales and bones cannot be counted with reasonable consistency; (2) the increments that are noted do not appear to give either a reasonable or a consistent pattern of growth; and finally, (3) the results are not consistent with growth as evidenced by tag returns.

The best estimate of albacore growth stems from the tag recoveries. Even this evidence is not as good as we would like, for there have been rather few recoveries and there is always the problem of obtaining reliable measurements at the time of tagging and recovery. The best results we have suggest a moderately rapid growth rate. The annual rate of increment for the several fish ranges from 6 to 27 pounds with the average closer to the lower value. Checking this material against hard parts has shed no light on the interpretation of the rings on the vertebrae and scales.

Perhaps one should not expect to be able to age albacore from the hard parts. They are not subject to the same extremes of summer and winter conditions as most fish of the north temperate zone, for they migrate to areas where food is available and water temperature is suitable for growth. Thus, as they seem to spend their life under fairly uniform conditions, "winter" rings would not necessarily develop on their scales and vertebrae.

North Pacific weather and climate

Two studies of North Pacific weather and climate were conducted as a part of the albacore program. They should be of general interest to fishermen and research workers in the North Pacific. The operational analysis of the winds was completed and a pilot study was made to determine the feasibility of preparing synoptic charts of the sea surface temperature from the data contained in ship's weather reports.

The wind analysis was prepared, with the operational requirements of a small research ship or fishing vessel in mind, from unpublished data obtained from the United States Weather Bureau. The aim was to show the expectation of suitable fishing weather in the North Pacific in all areas and months of the year. Sample contour charts were prepared for January and July showing the percentage of wind observations of 20 knots or less.

As an example of their use, it may be determined from the July chart that, in the area from 145° to 175° W. longitude, between 43° and 49° N. latitude, suitable fishing weather is present during 90 percent of the month, i. e., 9 out of every 10 days. The *Manning* made excellent gill-net catches in this area during July and August 1956. Her records showed that 109 out of 121, or 90 percent, of the 6 hourly wind observations made on board were 20 knots or less and also that 23 out of 26, or 89 percent, of the nights were suitable for gill netting, thus illustrating the reliability of the charts.

Quasi synoptic charts of sea surface temperature are the result of an attempt to utilize synoptic weather data for mapping the seasonal and annual changes in oceanographic conditions. Surface temperature was selected rather than other parameters such as wind and pressure since it appeared to give a more direct measure of the net effect of climate and weather on the ocean. The intensified program of United States Weather Bureau during recent years to increase the quality and number of ships' reports make possible the preparation of accurate and detailed charts for the northeastern Pacific. The charting is confined to the northeastern Pacific since the Japanese are already issuing similar charts for the northwestern Pacific.

INLAND FISHERY RESEARCH

THE DIGESTIVE ENZYMES OF SALMONIDS

This project was organized late in the fiscal year. Progress to date has included a literature survey, purchase of special equipment and establishment of the techniques necessary for the extraction, purification and characterization of the enzymes of Pacific salmon.

Some scattered work has been done on the digestive enzymes of fish. Pepsin has been crystallized from several species, including salmon. Tryptic enzymes have been reported in high concentration in the pyloric caeca of some fish. These enzymes appear to differ from analogous mammalian enzymes. However, not much is known about the particular enzyme system in the salmon. It is necessary to know qualitatively and quantitatively the enzymes present and how they differ from the mammalian counterparts. Because living conditions of fish, particularly body temperatures, are markedly different from those of warm-blooded animals, valuable information may be gained by comparing the relative activities and the optimum conditions for activity of the respective enzymes. In order to follow the change in digestive enzymes in living fish with change in environment, a quantitative method must be available for assaying crude extract for the various activities.

Objectives are: to isolate and characterize the digestive enzymes of salmonids by known chemical and physical techniques; to compare activities and specificities with those known for analogous mammalian enzymes; to develop and apply a method for determining the various enzymes in crude extracts; devise hatchery diets which are best suitable for salmon based on enzyme production of the fish.

The trypsin-like enzymes of the pyloric caeca of the chinook salmon will be isolated and crystallized by the general procedure described by Northrup, Kunitz, and Herriott for the isolation of enzymes from beef pancreas. Modifications may be necessary to adapt the method for the new source material. Preliminary work will be done using caeca collected from freshly caught salmon and stored at —40° C. until used.

The esterase activity in the various fractions of the isolation will be followed by the rate of hydrolysis of synthetic substrates. The release of free carboxyl groups in the substrates will be measured by the time required to produce a certain change in pH or by some more suitable method. By specificity for two different substrates, such as N-acetyl tyrosine ethyl ester and p-toluenesulfonyl arginine methyl ester, the distinction can be made between trypsin and chymotrypsin.

The isolated enzymes will be characterized by physical measurements such as electrophoretic behavior, sedimentation in the ultracentrifuge, and molecular weight determinations and by activity measurements to find optimum conditions of proteolytic activity; so as to compare the enzymes with those from mammalian sources. The optimum conditions for proteolytic activity will be determined by assays such as by the hydrolysis of casein method to distinguish, if necessary, between protease and esterase activity.

Procedures will be developed for determining qualitatively and/or quantitatively, the different proteolytic enzymes in crude extracts. This will be done either by the use of specific synthetic substrates for assay or by the use of column chromatography, such as with the new cellulose exchange resins, to separate and identify the individual components.

DISEASES OF PACIFIC SALMON

Funds were allotted late in the fiscal year for studies on the diseases of Pacific salmon both in fish hatcheries and in the wild. Two contracts ($7,600 and $1,500) were approved June 28 and 30 to permit the University of Washington to conduct studies on microorganisms parasitic on and pathogenic to fish, and to survey and investigate method for rapid isolation and enumeration of the nematode larvae (*Anisakis* species) in salmon muscle tissue.

Service personnel have also started work on fish diseases (parasites, bacteria and viruses) of salmon. Work has not progressed to the point where results can be reported.

FACTORS WHICH INFLUENCE MATURATION OF SALMON

A contract for a study of Pituitary Maturation Factors in Salmon was awarded to the University of Buffalo. Approximately 1,700 chum salmon (*Oncorhynchus keta*) pituitaries were collected at Quilcene, Wash. The pituitaries were lyophilized at the University of California Medical School at San Francisco, Calif., and forwarded to the University of Buffalo. A portion of the lyophilized glands were fractionated at the University of Buffalo. The fractions are being tested for ACTH activity at the university. A selected fraction was tested for gonadotrophic activity by injection into gonadectomized trout. These tests proved negative. Other fractions will be tested for gonadotrophic activity.

COMMERCIAL PROPAGATION OF CHANNEL CATFISH

The two accomplishments of greatest importance during this period are: 1. Proving that the channel catfish can be induced to spawn by the injection of pituitary; 2. proving that channel catfish injected in this manner will spawn in small containers in the hatchery holding house as well as in hatchery ponds. Five pairs of pituitary-injected fish spawned in 6, 10, or 35 gallon aquaria in the hatchery holding house at Tishomingo during the 1956 spawning season; 27 pairs so far during the 1957 spawning season. To date, no pair injected during the 1957 spawning season failed to spawn. Fry were obtained from each of these spawnings. At the present time we have an estimated 500,000 fry at the Tishomingo hatchery from pituitary-injected fish.

Three manuscripts were prepared for publication: (*a*) The spawning behavior of the channel catfish, *Ictalurus punctatus*; (*b*) The chemical control of some diseases and parasites of channel catfish; (*c*) Selected references on the channel catfish, *Ictalurus punctatus*.

Channel catfish were reared from eggs to 2½-inch fingerlings in metal troughs in the holding house. Fish were marked by tatooing and the numbers were readable 1 year after they were marked. This makes it possible to maintain the identity of the individual fish through several spawning seasons. Penicillin injections were used successfully to prevent mortality from serious injury due to spawning activity and from infection due to pituitary injections. Several hundred additional pituitaries were collected from carp, buffalo, and blue, flathead, and channel catfishes. Approximately 150 additional broodstock were collected. Additional experiments were conducted on the toxicity of various chemicals to channel catfish. A 2-day school was held for the superintendents of Federal hatcheries in the South and Southwest, instructing them on the latest findings on disease and parasite control, and nutrition in the channel catfish. During this school it was shown that a large part or all of the catfish crop of two of the Federal hatcheries in Texas were saved by the application of disease control methods developed by this research project.

GREAT LAKES FISHERY INVESTIGATIONS

Research financed by Saltonstall-Kennedy funds was started late in the fiscal year. A summary of the progress made to date is as follows:

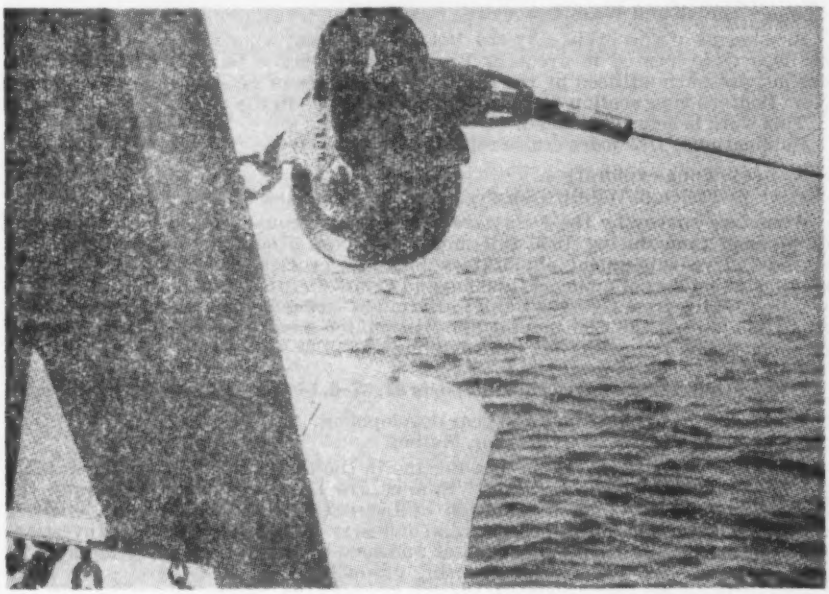
Lake Superior: Field headquarters for the Lake Superior project have been established at Ashland, Wis., with office and laboratory space at Northland Col-

lege. A project leader and an assistant have been assigned to Ashland to initiate the study of lake Superior fish not now fully utilized by the commercial fishery. Plans have been drawn and a contract let for refurbishing and equipping the motor vessel *Siscowet*, a 52-foot research vessel, which will be used to collect various life history stages of fish under study and determine their abundance and distribution.

Lake Erie: A project leader with headquarters at Ann Arbor, Mich., has been hired and assigned the task of organizing a study to explore the influence of the present selective fishery for a few preferred species on the total population. A supervisor for fieldwork and an assistant have been appointed and have established field headquarters at Sandusky, Ohio. The Great Lakes research vessel, motor vessel *Cisco*, is being used on Lake Erie during the 1957 season to supplement this project. Extensive studies are being made of the seasonal distribution and relative abundance of the various species of fish inhabiting the lake. This general inventory will serve as a basis for developing specific approaches to be undertaken in the project.

The motor vessel *Musky*, a 54-foot wooden trap-net boat, is being readied to serve as a project vessel for the Lake Erie studies. The boat and necessary field equipment should be ready when field headquarters have been established at Sandusky.

Great Lakes hydrography and meterology: A contract has been negotiated with the Great Lakes Research Institute of the University of Michigan to study the possible value of existing hydrographic and meteorological data in describing the physical-chemical features of the aquatic environment of the Great Lakes. This information will ultimately be used as a basis for evaluating the effects of hydrographic influences on wide fluctuations in abundance characteristics of fish in the Great Lakes. The uncertainty caused by those fluctuations has, in many areas, prevented full utilization of exploitable fish stocks.



New electrical telemeter passes through towing block on stern off the *John N. Cobb* during midwater trawl exploration off Pacific coast. With this instrument fishermen can read the depth of the net from a dial in the pilot house.

Progress In Commercial Fishery Studies

EXPLORATORY FISHING AND GEAR RESEARCH

1. North Atlantic fishery exploration and gear research.
Headquarters: East Boston, Mass.

Reduced trawl catches from some traditional New England coastal fishing areas have forced trawlers to make longer and more distant voyages. It is necessary to locate new resources and to assist in technological advancements to improve the industry's position with respect to increased foreign competition.

Trawl investigations with conventional otter trawls and experimental midwater gear have been carried on in an area from the Gulf of Maine to Georges Bank to depths of 400 fathoms for additional demersal and midwater resources. Shellfish (scallop) exploration is being conducted for possible extension of the productive fishing grounds. Offshore pelagic fishery potentials are being surveyed for new resources within reach of New England fishing vessels.

(*a*) Trawl exploration.
Fish and Wildlife Service: East Boston, Mass.

Exploration for ocean perch, haddock, and other species was continued during two cruises by the *Delaware* using conventional otter trawls. The *Delaware* and *Albatross* conducted a preliminary comparison of the relative efficiencies of standard types of trawls when towed in pairs. Four *Delaware* cruises with midwater trawl gear failed to take ocean perch in any numbers and this work has been discontinued pending improvements in gear and methods. Future plans include additional bottom trawling with experimental types of gear.

This work is being continued.

Publication: *Delaware* cruise Reports 22, 23, 24, 25, 26, and 57–2.

(*b*) Shellfiish exploration.
Fish and Wildlife Service: East Boston, Mass.

As a result of two cruises by the *Delaware* concentrations of commercial-sized scallops were located in areas of Browns and Georges Banks. These grounds are not presently utilized by the fishing fleet. Types of gear used were standard New Bedford type scallop dredges and modifications to the gear.

This work is being continued.

Publications: *Delaware* cruise reports 28, 57–4.

(*c*) Tuna exploration.
Fish and Wildlife Service: East Boston, Mass.

A surface survey by the *Delaware* with aerial reconnaissance located schools of bluefish tuna during 1956 fall months on New England Contintental Shelf waters. Two subsequent exploratory long-line cruises by the *Delaware* made significant catches of albacore, bluefin, and yellowfin tuna in offshore Gulf Stream waters ranging from Georges Bank to Bermuda. Bluefin tuna were found for the first time beyond the Continental Shelf in winter months and the known ranges of albacore and yellowfin tuna were extended.

This work is continuing.

Publications: *Delaware* cruise Reports 27, 57–3, 57–5.

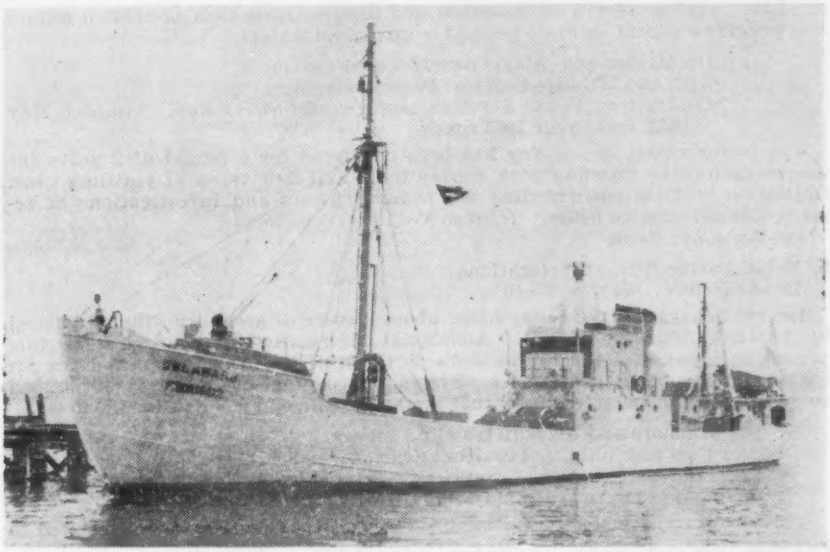
2. Main sardine explorations and gear development.
Headquarters: Boothbay Harbor, Maine.

In recent years there has been a decline in the abundance of herring suitable for processing as Maine sardines. Studies are being conducted to survey the seasonal occurrence and distribution of herring in both inshore and offshore waters to better inform the commercial industry of fish movements. Investigations are underway with experimental and new or improved fishery methods to assist the industry in increasing herring production.

(*a*) Herring exploration and gear development.
Fish and Wildlife Service: Boothbay Harbor, Maine.
Contractor: Vessel services, motor vessel *Metacomet*, Gloucester, Mass.
Awarded April 1956, fiscal year 1956 funds.

During the period July 1 to November 30 the *Metacomet* completed *eight* cruises to assess the extent and availability of offshort stocks of sardine-sized herring. Offshore surveys found comparatively few sardines and most of the herring samples taken were from scattered fish or small schools. In relation to western Maine runs of sardines, eastern runs were smaller during the fall of 1956. Despite incomplete information the survey gave little reason for optimism

regarding offshore herring-fishing posibilities. The use of midwater trawls was effective in sampling schools with no significant results in attempts to take larger herring. A successful air pressure depth meter was developed for use with midwater trawls. The power block method of handling stop-seines was demonstrated at Gulf of Maine fishing ports.



Exploratory fishing and gear research vessel *Delaware*, East Boston, Mass.

One cruise by the *Delaware* was made to complete offshore plankton sampling for biological work in connection with the Maine herring studies.

This work in continuing.

Publications: *Metacomet* Cruise Reports Nos. 4, 5, 6, 7, 8, 9; Air Pressure Depth Indicator, Commercial Fisheries Review, February 1957.

3. South Atlantic fishery explorations.
Headquarters: Pascagoula, Miss.
Operations base: Jacksonville, Fla.

This program involves a systematic survey of the South Atlantic coast for new fish and shellfish resources. Small-scale investigations by State or other agencies in the past indicated promise for additional exploratory work in this area. Complete coverage of the waters of the Continental Shelf and adjacent deep waters is needed to increase the future prospects of the fisheries of the Southeastern United States.

(*a*) Trawl exploration, deep water.
Fish and Wildlife Service: Jacksonville, Fla.
Contractor: Vessel services, motor vessel *Combat*, Southern Seafood Transport Inc., Tampa, Fla. Awarded June 1956, fiscal year 1956 funds.

During 1957 explorations were continued off the Southeastern States following 1956 discoveries of royal-red shrimp. The motor vessel *Combat* completed 5 cruises using commercial sized gear in deeper waters to 300 fathoms from North Carolina to the Dry Tortugas Islands. As the result of promising catches in several areas small-scale commercial fishing operations began in February 1957. Exploratory operations in this area will be expanded to investigate possibilities of additional resources on the Continental Shelf between Cape Hatteras and Cape Canaveral.

This work is continuing.

Publications: *Combat* Cruise Reports Nos. 4, 5, 6, 7, 8.

4. Gulf of Mexico explorations.
Headquarters: Pascagoula, Miss.

Present indications are that future international conditions may result in closure of certain areas now fished by commercial vessels in the Gulf of Mexico. Investigations are needed to discover new possible resources and new fishing available to Southern States fishermen. A second vessel is required to supplement the Service vessel now commissioned to investigate Gulf of Mexico waters and to carry exploration to deeper and more distant waters.

(*a*) Deepwater and pelagic fisheries exploration.
Fish and Wildlife Service: Pascagoula, Miss.
Contractor: Vessel Services, motor vessel *Silver Bay*. Awarded May 1957, fiscal year 1957 funds.

The motor vessel *Silver Bay* has been chartered for a period of 2 years for use in deepwater trawling with conventional and new types of trawling gear. Objectives will include trawling for pelagic shrimp and investigations of resources in sardinelike fishes. (Cruise No. 1 just completed.)
Publications: None.

5. North Pacific fishery explorations.
Headquarters: Seattle, Wash.

International conditions may bring about closure of areas traditionally fished by Pacific Northwest vessels. Additional information is required regarding promising areas explored by the *John N. Cobb* off the Washington and Oregon coasts and in southeastern Alaska. Systematic coverage of these areas is planned to develop new fishery resources that might be utilized by North Pacific fleets.

(*a*) Offshore and Alaskan trawling survey.
Fish and Wildlife Services: Seattle, Wash.
Contractor: Vessel Services, motor vessel *Tordenskjold*, Seattle, Wash. Awarded May 1957, fiscal year 1957 funds.

This project has just been initiated. The *Tordenskjold* has been chartered to locate profitable alternate trawling grounds in southeastern Alaska. The vessel will also survey the coastal waters of the Alaskan Peninsula and eastern Aleutian Islands for additional trawling and king crab fishing grounds.
The work will continue.
Publications: None.

6. Gear development and research.
Headquarters, Miami, Fla.

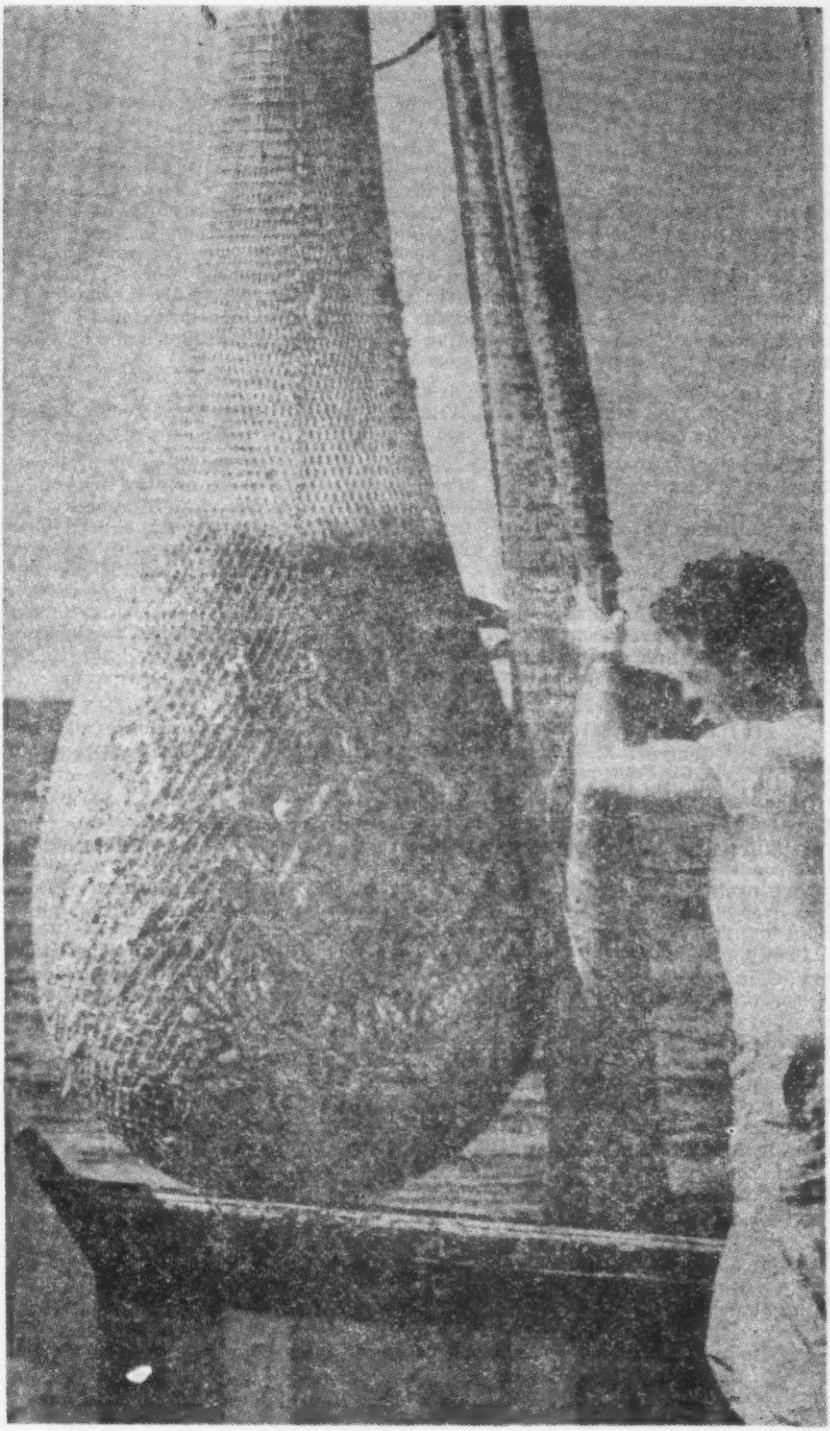
The gear research activity conducts investigations in fishery methods and equipment which are of a specialized nature yet national in scope or application within the domestic commercial fishing industry. Studies of conventional and experimental types of fishing gears and accessory equipment or instrumentation are carried on in cooperation with State, Federal, and other research agencies.

(*a*) Shrimp trawl studies.
Fish and Wildlife Service: Miami, Fla.

In March 1957 a study of the design and operation of shrimp trawls was initiated. The physical performance of conventional and modified trawls will be observed and recorded by use of divers with SCUBA gear, cameras, and underwater television equipment. The reaction of fish and shrimp with respect to capture by the trawls is being studied.
This work is continuing.
Publications: None.

(*b*) Design and Studies for freezing-at-sea trawler.
Fish and Wildlife Service: Washington, D. C.

In June 1957 a contract was awarded to a New England firm for design studies of a larger freezing-at-sea type trawler. Preliminary design studies and plans will be drawn for a vessel type which might assist in solving some of the problems facing the New England ground fish industry. The work will be performed by the contractor in consultation with Bureau of Commercial Fisheries representatives and in cooperation with the New England commercial industry.
This work is continuing.
Publications: None.



Good catch of royal red shrimp coming aboard exploratory fishing vessel.

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FISHERY TECHNOLOGICAL STUDIES

1. Middle Atlantic and gulf research.
Headquarters: College Park, Md.

Historically, the oyster industry of the South Atlantic and Gulf States has differed from that of Chesapeake Bay and the Middle Atlantic. Growth rates, seasonal cycles, pests, and diseases differ considerably for these two areas. Since these differences extend to the physical and chemical nature of the shucked oysters, different procedures of handling and packing the raw oysters are required. In the past also, southern oysters have been subject to more lenient interpretations of the Food and Drug Administration regulations for free liquor. Research in technological aspects of the industry has had the general object of increasing knowledge of the southern oysters in the broad fields of: (1) composition and factors affecting variability; (2) physiology, especially in relation to liquor loss, salt exchange, and naturally occurring discoloration; and (3) handling, processing, and storage, including cooked and frozen products and development of various tests for quality of stored products.

(*a*) Composition of southern oysters.
United States Fish and Wildlife Service: College Park Technological Laboratory.

Knowledge of the composition is essential to an understanding of problems involved in handling this product. The investigation of the content of dry solids, protein, fat, mineral matter, chlorides, and carbohydrates (by differences) has been continued through a second full season, November 1955 through October 1956. Analysis of the more than 125 oyster samples collected has only recently been completed and data have not been studied. Preliminary conclusions confirm those reached from the data for the first season, and this study has not been continued during the third year. Supervision of the contract research and liaison between government, contractors, and industry will be maintained to the conclusion of the three contracts in June 1958.

Analytical studies aspects have been concluded.

Publications: None.

(*b*) Physiological investigations of fluid losses and coloration of oysters.
Contractor: Tulane University, New Orleans, La. (Contract renewed for February 1957–June 1958.)

Basic studies of the physiology of *Crassostrea virginica*, the eastern oyster, have been continued. An interesting comparison was made between oysters from two different mid-Atlantic oyster growing areas and Louisiana oysters, under like conditions of stress. Negligible differences in total fluid exuded existed for spring oysters from the two areas. However, fall samples of southern oysters lost over 60 percent more fluid in a given time than New Jersey oysters, while fluid loss from Chesapeake oysters was between the extreme values.

Brown discloration of the southern oysters is still under study. The cause is not yet known, since it has not been possible to increase the rate of incidence of spotting experimntally in the laboratory. It has been found that even very small oysters, barely past the spat stage, show brown discoloration which might indicate a purely genetic origin.

The composition of the body fluid or "blood" of the oyster has been investigated, and differences were observed of content of salt and protein in the fluids from the heart and three other parts of the oyster body . Histophysiological research is now underway on the kidney (organ of Bojanus) and related structures to determine their function in fluid exchange.

This contract is being continued.

Publications:

Heat Death and Associated Weight Loss of the Oyster *Crassostrea virginica;* Tulane Studies in Zoology, volume 4, April 1957.

Bleeding and Heat Death in the Southern Oyster, Commercial Fisheries Review; October 1956.

Body Fluid Losses of Northern and Southern Oysters; Commercial Fisheries Review (in press).

Body Fluid of the Oyster *Crassostrea virginica;* Texas Journal of Marine Biology (in press).

Demonstrating use of power block for hauling Maine sardine stop seine.

(*c*) Investigation of frozen products using southern oysters and development of chemical and physical tests for oyster conditions and quality during storage.

Contractor: Florida State University, Tallahassee, Fla. (Contract renewed for February 1957–June 1958.)

Florida oysters have been individually frozen in various ways, including brine mixtures and the use of antioxidants, and the quality changes during storage were observed. Problems of preparing a palatable frozen oyster stew with these oysters have also been studied, and an acceptable formula has been developed. The TBA test developed last year for use with oysters does not show a consistent increase with raw oysters, but seems correlated to quality of cooked oysters.

A micro-test for glycogen using anthone has been successfully adopted to use with oysters. This will permit the study of a number of problems relating to glycogen content of oysters, such as the seasonal fluctuation of glycogen, rate of disappearance after shucking under various storage conditions, amounts lost in liquor during initial bleeding and in the liquor formed after washing during storage, and the development of an empirical test for oyster condition. This last factor is of especial importance in judging acceptability of oysters for freezing. Investigation is already under way on some of these problems, and will be continued.

This contract is being continued.

Publications:

Correlation of pH and Quality of Shucked Southern Oysters, Commercial Fisheries Review; November 1956.

Deterioration of Cooked Southern Oysters, Food Technology, January 1957.

Application of the Thiobarbituric Acid as a Quantitative Measure of Deterioriation in Cooked Oysters; Food Research, volume 22, No. 1, 1957.

Effect of Radiation on Oysters; Food Technology (in press).

(*d*) Investigations of factors affecting quality of frozen southern oysters.

Contractor: Louisiana State University, Baton Rouge, La. (Contract renewed for February 1957-February 1958.)

The effect of dips in several inorganic salts for controlling the amount of drip and loss on cooking of frozen oysters led to selection of sodium phosphate as a dip having some promise. Alabama oysters were treated with four mixtures

of sodium phosphates in the pH range, 6.5 to 7.5. Other lots were packaged and frozen with various differences in washing, including blowing. Control lots of Chesapeake Bay oysters and Louisiana oysters of different grades were included in the storage test series. The data recorded for these series included the count, percentage with dark-edged mantle, general color, percentage loss on cooking, bacterial counts, and organoleptic scores. These factors, and the amount of drip, are determined at monthly intervals during storage tests.

Several lots of oysters, immersion-frozen in different brine formulas, have also been prepared. In general this process accelerates the development of off-colors and flavors associated with quality loss in frozen storage. These frozen storage studies are being continued.

This contract is being continued.

Publications: None.

2. Development of voluntary United States standards for fishery products.
Headquarters: United States Fish and Wildlife Service, Washington.

The cooperative agreement with the Department of Agriculture was implemented to make available to the industry two voluntary United States standards for fishery products. The standards for frozen fried fish sticks are now in effect. The proposed voluntary United States standards for frozen raw breaded shrimp have been promulgated by a notice of proposed rulemaking in the Federal Register. Continuing advice and guidance are being given to the Department of Agriculture inspection group supplying continuous inspection and grading services to the fishing industry.

Development of standards for (1) frozen fish blocks; and (2) frozen fish portions, fried or raw, is nearly complete. Background information is being collected for standards on (1) "green" shrimp, (2) blue crab, and (3) fish fillets.

Publications: United States Standards for Grades of Frozen Raw Breaded Shrimp—Notice of Proposed Rulemaking; Federal Register, May 18, 1957.

(*a*) Voluntary United States standards for fishery products.
United States Fish and Wildlife Service: College Park Technological Laboratory.

The characteristics determining the quality of frozen raw breaded shrimp were defined and classified. Whenever possible, objective tests were developed to measure these characteristics. Tentative drafts of the proposed United States standards for frozen raw breaded shrimp were prepared and disseminated to industry. A series of five meetings with industry representatives was held to obtain their comments on the proposed standards and some revisions were made to conform with their suggestions. The final draft was discussed with Department of Agriculture personnel, and after some alterations, was published in the Federal Register of May 18, 1957, as notice of proposed rulemaking.

Some research on frozen raw breaded shrimp is continuing, notably a 12-month storage test.

Future work will include development of background information for use on standards for crabmeat and frozen raw headless shrimp as the need for them is demonstrated.

Publications: Three Styles of Breading Permitted Under Proposed Shrimp Standards; Quick Frozen Foods, January 1957.

(*b*) Voluntary United States standards for fishery products.
United States Fish and Wildlife Service: Boston Technological Laboratory.

The United States Standards for Grades of Frozen Fried Fish Sticks were published in the Federal Register July 21, 1956 (21 F. R. 5475) and became effective August 21, 1956. The standards and inspector's manual for grading fish sticks were prepared by the Fish and Wildlife Service and issued by the Department of Agriculture in accordance with an informal cooperative agreement between the two agencies. Approximately seven commercial fish-stick producers have adopted voluntary Federal inspection and grading services as a convenient basis for sales, for establishing quality-control programs, and for determining loan values.

Public meetings were held to receive comments on the provisional drafts of the frozen fish fillet block standards and inspector's manual for grading the product. Further experimental data were collected to resolve the comments and a revised provisional draft prepared.

Data are being collected on frozen-fish portions for characterizing the quality factors essential to development of grade standards and for developing test procedures by which these quality factors can be evaluated. An X-ray fluoroscopic method has been adapted for detection of bones in fish portions as well as in fish sticks and other fishery products.

Publications:

Proposed United States Standards for Grades for Frozen Fish Blocks (provisional draft); United States Department of the Interior, Washington, D. C., October 24, 1956.

Reduction of Dehydration in Frozen Fish Fillet Blocks; Commercial Fisheries Review, June 1956.

Determining Fish Content of Frozen Fried Fish Sticks; Commercial Fisheries Review, January 1957.

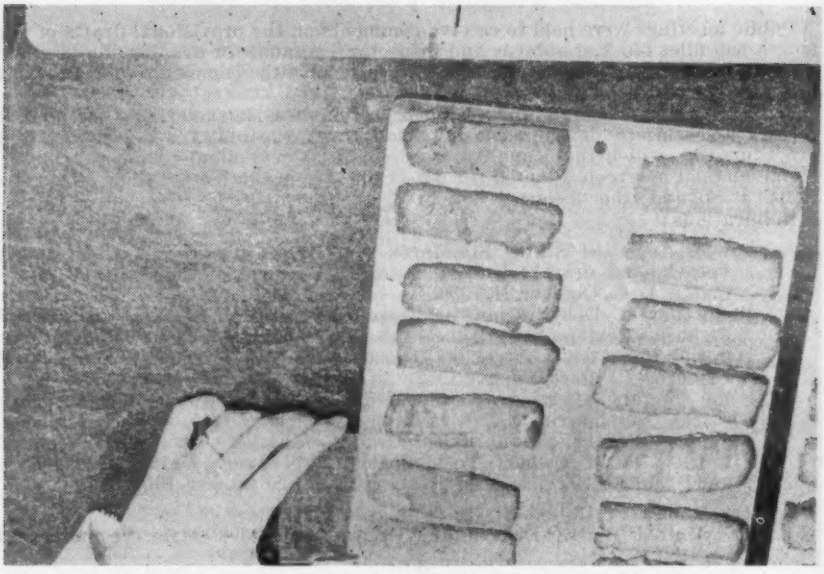
Some Factors Affecting "Sawdust" Losses During the Cutting of Fish Sticks; Commercial Fisheries Review, February 1957.

Voluntary Federal Standards for Grades of Fishery Products; Technical Release No. 3, Fishery Technological Laboratroy, United States Fish and Wildlife Service, East Boston, Mass., November 1956.

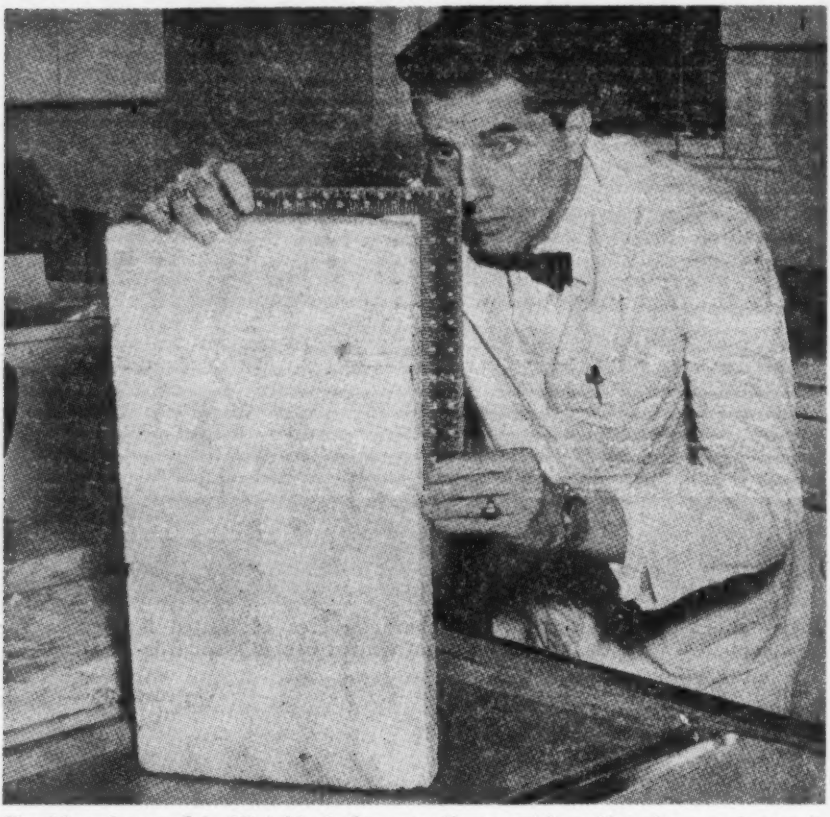
(*c*) Voluntary United States standards for fishery products.
United States Fish and Wildlife Service: Seattle Technological Laboratory.

Pertinent Pacific-coast background information was obtained on frozen fish fillet blocks and raw breaded shrimp for the voluntary standards. Drafts for the proposed standards were reviewed. Meetings to consider the proposed standards were held with west-coast industry representatives.

Inspector checks flavor and odor characteristics of heated fish sticks for compliance with the requirements of United States standards for grade.



Inspecting fried fish sticks for continuity of breading coating for compliance with requirements of the standards for this fishery product.



Checking frozen fish fillet block for compliance with uniformity requirements of proposed standards for this fish stick raw material.

Pacific coast data were collected on frozen raw breaded fish sticks, and frozen raw breaded or unbreaded fish portions. A preliminary draft of a proposed voluntary standard for frozen raw breaded fish sticks and frozen raw breaded fish portions was prepared.

Laboratory personnel consulted with industry on various fish-quality problems in relation to the standards program and provided technical information or suggestions to help solve these problems. An active liaison was maintained with the National Fisheries Institute, Inc., representatives in their Pacific coast work, including consultation on quality problems in fresh-fish production, and the annual Seattle evaluation of west coast frozen packaged fillets and steaks.

Work in progress includes the evaluation of current industry problems for the continuing development of voluntary standards for Pacific coast fishery products on an industry-need priority basis.

Publications: Storage Tests on Frozen Fried Fish Sticks Prepared From Pacific Cod; Commercial Fisheries Review, July 1956.

(*d*) Technological program to improve the quality of fresh fish and develop standards for fish products.

Contractor: National Fisheries Institute, Inc., Washington, D. C. (Contract awarded December 1956, fiscal year 1957 funds.)

The National Fisheries Institute technologists have effectively served as a liaison between the Bureau and the industry. The latter's interest and participation in cooperative quality-improvement programs have been promoted through frequent group meetings and numerous individual contacts.

The industry was assisted in developing and adopting Rules and Standard Procedures for Quality Improvement (for use on a voluntary basis) for New England Trawlers and Primary Wholesalers. Similar standards for handling of fresh fish are being developed for the Pacific coast salmon and trawl fisheries and for the Atlantic coast small-boat operations.

Several producers and distributors have been induced to use the fish stick grade standards, officially effective August 21, 1956. Industry's efforts in the development, and revision of similar standards for other products, have been coordinated: breaded shrimp, proposed standards published May 18, 1957: fish fillet block standards soon to be published; crab meat, breaded fish portions, shrimp and fish fillet standards yet in preliminary developmental stages.

This contract is being continued.

Publications: Rules and Standard Procedures for Quality Improvement. (Available from Fish and Wildlife Service or National Fisheries Institute, Inc.)

(*e*) Evaluation of freshness test for fish.

Contractor: University of Washington, Seattle, Wash. (Contract completed May 1957.)

Each of the chemical indices under study—total volatile acids, total volatile base, volatile-reducing substances, trimethylamine, and hydrogen sulfide—has been evaluated in relation to the spoilage of fresh sole and Pacific cod. Twelve test series were prepared in which the test species was held in either crushed ice, dilute brine at 32° F., or brine at 50° F. Progressive examination of samples from each series was made until the remaining fish were judged organoleptically spoiled and unfit for consumption. None of the chemical procedures tested proved to be completely reliable as an objective index of the freshness of the fish; however, loss of freshness appeared to correlate to some degree with all procedures. The hydrogen sulfide determination was the least reliable of the methods used as an indication of increasing spoilage. Spoilage of sole in brine at 50° F. proceeded to the point of inedibility in approximately one-fourth the time required for the fish in crushed ice or in brine at 32° F.

Technical findings from the study have been reported informally to industry representatives concerned with quality control of fresh fish.

This contract is completed.

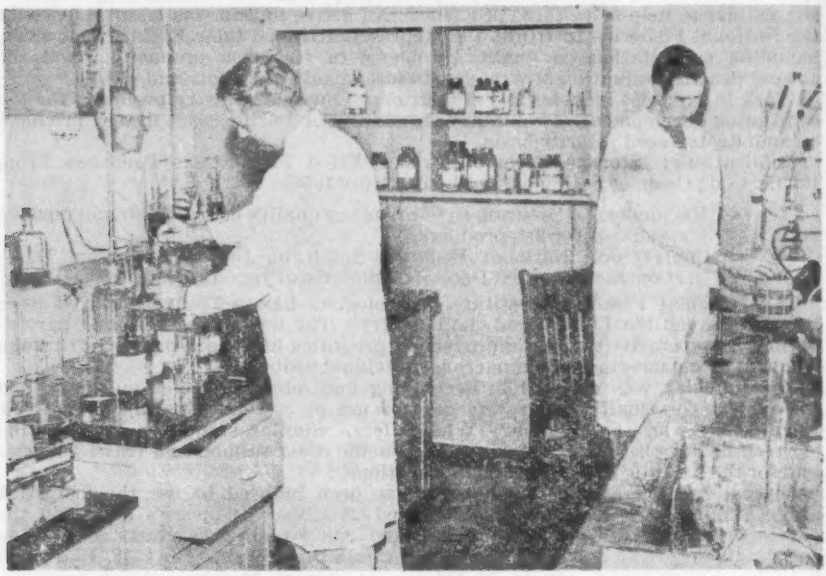
Publications: None.

(*f*) Development of new objective test for quality of fresh, frozen, and processed fish.

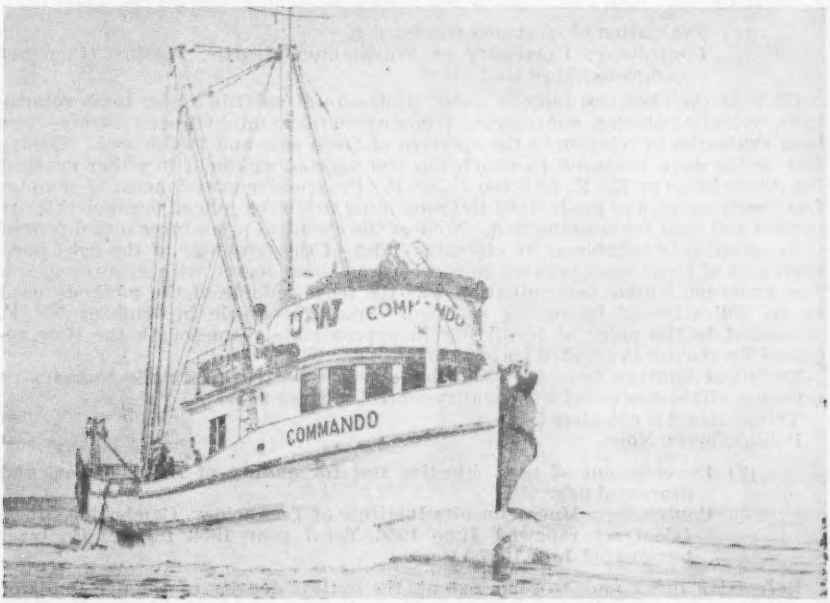
Contractor: Massachusetts Institute of Technology, Cambridge, Mass. (Contract renewed June 1956, fiscal year 1956 funds. Contract terminated June 1957.)

Refractive index and, to some extent, the optical density of the eye fluids of haddock are good criteria of the quality of fish which have been stored at refrigeration temperatures above freezing. Excellent correlation was obtained

when the physical tests on the eye fluids of the fish were compared statistically with the storage time of the fish and with organoleptic scores. Several colorimetric tests—creatinine, histamine, and thiobarbituric acid—did not appear suitable. The malachite green oxalate reduction (colorimetric) test appeared to give promise as a rapid test for fresh fish quality.



Evaluating the freshness of fish by chemical methods in the laboratory of the School of Fisheries, University of Washington, as a part of the contract research program.



Motor vessel *Commando*, vessel of the University of Washington, used to obtain fish for freshness studies on the contract research program.

The study was then diverted to the identification of compounds in fish meat which might serve as criteria for quality. It appears that vaporphase chomatography combined with mass spectrography may be a suitable means of identifying compounds for which chemical tests may be developed. Since these compounds produced during spoilage are present in minute amounts some method of concentration must be employed prior to vapofractometer separation. This contract is completed.

Publications: None.

(*g*) Investigation of causes and prevention of black spot in shrimp.
Contractor: Marine Laboratory, University of Miami, Coral Gables, Fla. (Contract awarded June 1956, fiscal year 1956 funds. Terminated June 1957.)

Handling, icing, and vessel storage factors are being studied for their effects on the formation of black spot in shrimp. Such variables as length of drag, prewashing of the catch before vessel storage, bruising of the catch, and methods of icing on whole and headed shrimp were studied.

In drags of less than 5 hours' duration, time does not appear to be a factor in inducing black spot.

No significant differences were noted due to prewashing samples before storing.

Intentional bruising did not appear to affect the development of black spot.

Shrimp allowed to lie on deck for 2 hours before icing generally showed more black spot development than those shrimp treated and iced immediately. Shrimp iced in a layered fashion (alternate layers of shrimp and ice) generally showed less black spot development than shrimp handled in a similar manner but stored in ice in a mixed fashion (each shrimp surrounded by particles of ice).

Additional experiments are being conducted to check upon the effect of the variables in the method of icing and delays in icing.

A voyage of 14-days' duration was made by the contractor to the Campeche fishing grounds on a commercial shrimp vessel where observations were made on the handling, and samples taken. These shrimp were transferred at sea from one boat to another in the usual manner and returned to port for further study.

The contract is completed.

Publication: None.

(*h*) Improved handling of fish aboard vessels.
Division of Marine Fisheries, Department of Natural Resources, Commonwealth of Massachusetts, Boston, Mass. (Contract awarded June 1957.)

The proposed work consists of (1) survey of present practices aboard commercial fishing vessels; (2) preparation of recommendations for improving these practices; (3) directly instructing the fishermen in ways of improving these practices aboard vessels; and (4) grading of the fish handled under the improved conditions when they are landed at the dock. The basic objective is to teach the fishermen modern improved concepts of fish handling aboard the vessel and to demonstrate firsthand the economic advantage to them when good-quality fish are landed.

This contract is being continued.

Publications: None.

3. Development of chemical index for nutritive value of fish meal.
Headquarters: United States Fish and Wildlife Service, Washington, D. C.

The need for precise data on the nutritive value of fish meal—(1) its possible variation as a function of processing methods or storage conditions, (2) its most effective level in the diet, and (3) its ultimate amino acid composition—has been the all-important factor which has guided the fish meal quality index research program. Studies have been completed in some phases of the work; other phases are now entering the final stages. Detailed studies which attempt to relate the availability of specific amino acids to an observed nutritive value are now underway.

(*a*) Quality index of fish meals.
United States Fish and Wildlife Service: College Park Technological Laboratory.

Fish meal samples of known history were collected by the College Park Laboratory personnel from producers along the east coast. They were analyzed for proximate composition, then distributed to the contractors for further chemical, microbiological, and poultry feeding studies to be performed on these meals of

known history and composition. The objective of the contractors' research is to evaluate, by biological and chemical means, the nutritive value of fish meal and to develop a rapid method for evaluating the nutritional quality and feeding value of these products.

A study was made by personnel of the College Park Laboratory to determine the adaptability of several known tests for changes occurring in oil to relate quality of raw fish to quality of meals made from them. These tests proved to be of negative value for this purpose.

The research is continuing.

Publications: Feeding Studies With Menhaden Press Cake; Commercial Fisheries Review, May 1957 Supplement.

(*b*) The assay of of fish meals for their feeding quality in chick diets. Contractor: University of Delaware, Newark, Del. (Contract renewed June 1957.)

Fish meals of known history, supplied by the United States Fish and Wildlife Service, have been tested for nutritive quality of protein by including a limited amount in an otherwise complete, practical broiler diet. Groups of chicks have been fed these comparative diets for a total of 10 weeks. The gain in weight and the feed requirement have been the indices used to determine nutritive quality.

Data are known for 10 separate processing variables included in over 160 separate samples of fish meals collected from reduction plants along the Atlantic, Gulf, and Pacific coasts, as well as in the Territory of Alaska. Over 6,000 chicks have been grown on the experimental diets to 10 weeks of age and an average weight of over 4 pounds per bird. A study of the data reveals that some differences exist between experiments as was anticipated at the beginning of the project. Due to these differences, the data have been alalyzed statistically on an individual experiment basis and these analyses used in interpreting results. In general, the differences between the results attributable to the samples of fish meal used were smaller than had been anticipated. When the data were studied in detail, it was found that in a few instances the differences in the results due to differences between samples of fish meal were highly significant. A few experiments were conducted with diets containing various nutrient supplements. Chicks fed the corn-soy control diets responded to differences in protein and energy levels as well as to the supplements of an unrecognized mineral supplement present in incinerated chicken ash and to supplementary methionine but not lysine. In general, the chickens fed diets containing fish meals showed slightly, but not significantly, superior growth when compared to those fed the corn-soy meal control diet. There was an indication that growth responses of birds fed diets containing fish meals were not optimum, probably because of a deficiency in the diet of some nutrient.

This work is being continued with feeding experiments conducted under commercial-type conditions with comparable groups housed in floor pens and in battery cages to determine effects of crowding, etc., on the evaluation of the nutritive value of different samples of fish meal. Further tests will be conducted on modifications of the control broiler diet.

The contract is being continued.

Publications: None.

(*c*) Nutritive value of fish scales for animal feeding. Contractor: University of Massachusetts, Amherst, Mass. (Contract awarded February 1956.)

Fish scales are a waste product of the fish industry (except for the limited quantity of herring scales used for pearl essence) and they have no economic value but instead pose an economic problem of disposal. This study on the use of scales for animal feeding was designed to develop a profitable outlet for commercial utilization of the byproduct. Fish scales contain a substantial amount of protein and minerals. The problem was to determine whether these nutrients were nutritionally available to the live animal (chicks) when fed diets containing fish scales. It was found in chick-feeding tests with ocean-perch scales that: (1) Ocean-perch scales contain 50 percent protein; and (2) the addition of ocean-perch scales to fish meal as 5 percent of the total protein does not adversely affect the nutritive value of the meal. Addition of this amount of scales to fish meal would provide a profitable outlet for the waste

products and would automatically eliminate a waste disposal problem since all the scales produced would be incorporated into the meal.

The contract is completed.

Publications: None.

(*d*) Quality index of fish meals.
United States Fish and Wildlife Service, Seattle Technological Laboratory.

Factors that may affect the nutritive value of fish meal are being studied to learn the causes for differences in nutritive quality of fish meals. Effects of extremes of processing and storage conditions are being determined. A pilot-plant fish-meal drier was designed and built so that variables cauld be introduced and controlled and runs could be repeated. The values of the protein and amino acids as a whole are measured by chick-feeding tests at the University of California. Unknown factors are measured by chick-feeding studies at the University of Wisconsin. Chemical studies are being made. Proximate composition is determined and differences in the oil content are measured by changes in solubility in ether and acetone.

A literature review of various factors that can affect the quality of processed feeds was completed. Abstracts of articles applicable to ten phases of the problem were duplicated and made available to contractors and other workers in the field.

This research is being continued.

Publications:

Dye-Binding Characteristics of Fish-Meal Protein. Part 1—Some Preliminary Findings as to Suitable Dyes; Commercial Fisheries Review, May 1957 Supplement.

Pilot-Plant Fish-Meal Dryer; Commercial Fisheries Review, December 1956.

Progress of Studies on the Nutritive Value of Fish Meal; Commercial Fisheries Review, May 1957.

Vitamin Content of Fishery Products. Part III—Riboflavin, Nicotinic Acid, Vitamin B_{12}, Moisture, Oil, and Protein Content of Commercial Fish Meals; Commercial Fisheries Review, May 1957 Supplement.

(*e*) Quality index of fish meals.
Contractor: University of California, Davis, Calif. (Contract renewed for fiscal year 1957.)

The nutritive quality of fish meals is determined by chick-feeding tests that measure the meals as a source of amino acids. The effects of factors such as time and temperature of storage of the meal, processing conditions, spoilage of both raw and cooked raw material are being studied. Precooked, spoiled tuna waste yields a meal of very low protein quality. This raw material has been extracted in an attempt to determine what the toxic material is. It is not histamine. It is stable to heat and soluble in cold water. In addition to these tests for the overall nutritive value of the meal, methods are being developed to measure availability to the chick of individual amino acids.

This contract is being continued.

Publications: Effect of Raw Material on Tuna-Meal Quality; Commercial Fisheries Review, July 1956.

(*f*) Investigation of unknown growth factors in fish meal. Contractor: University of Wisconsin, Madison, Wis. (Contract renewed for fiscal year 1957.)

Assays for unknown growth factors in fish meals are being made. Seventeen assays were run and only two failures resulted. This is probably a record for consecutive successful unknown growth factor assays. Bacterial flora of the chick digestive tract may be important in the response to growth factors. Effects of storage and processing conditions on unknown growth factors are being measured. Menhaden, salmon, and tuna meals were tested. They were compared with solubles that had been assigned a value of 10 units. Potencies of the meals ranged from 2.5 to 13.8 units. Differences that occurred among the meals could not be traced to any information known about the meals.

This contract is being continued.

Publications: Determination of Unknown Growth Factors in Fish Meals by Chick-Growth Studies; Commercial Fisheries Review, May 1957 Supplement.

(*g*) Amino acid availability and vitamin content of fishery products.
Contractor: Wisconsin Alumni Research Foundation, Madison, Wis., (Contract awarded for June 1956 to June 1958.)

Assays of amino acids are being conducted by *in vitro* methods to learn whether changes in nutritive value to the chick can be correlated with *in vitro* measurement of amino acid content. Amino acids determined by microbiological assays were: arginine, histidine, valine, tyrosine, methionine, tryptophan, glycine, lysine, leucine, isoleucine, and cystine. Available and total amino acids as well as rate of liberation were measured. Total amino acid is the amount released by enzyme hydrolysis. Both the rate and percentage of amino acid released by enzyme hydrolysis varied among the amino acids assayed. More meals must be analyzed and compared with results of chick tests before conclusions can be made about what differences these variations make in the nutritive value of the meals.

This contract is being continued.

Publications: None.

(*h*) Protein quality of fish meals.
Contractor: University of Wisconsin, Madison, Wis. (Contract awarded June 1957.)

Objectives are to study effects of fish meal as a protein supplement for chick-starting diets. Fish meal will be incorporated at different levels with diets containing corn and other vegetable proteins and the effects measured by growth rate of chicks and by efficiency of feed utilization.

This contract is being continued.

Publications: None

4. Development of new uses for and new products from fish oil.

The detailed program of nationwide research into the nature, properties, and possible uses of fish oils has been vigorously prosecuted. Studies of the unique chemical reactivities, of the mechanisms of oxidation, of the odor problem, and of methods of separation of the fish oil fatty acids are now bearing fruit. Two public service patents are under consideration. A technique for reversing the undesirable colorations sometimes found in canned tuna has been developed. Continuing assistance is being given the fish oil industry as research progresses.

(*a*) New products from fish oils.
United States Fish and Wildlife Service, Seattle Technological Laboratory.

Chemical reactions are being performed with triglycerides, fatty acids, and fatty-acid methyl esters from fish oils. These studies are intended to produce derivatives of fish oils that may have industrial uses.

Sardine oil has been chemically reduced to long-chain fatty alcohols. The unsaturated fractions of these alcohols have been used to form alkyl halides, which in turn, are transformed into substances such as quaternary ammonium salts. Quaternary ammonium salts from fish oils have been shown in laboratory tests to be 32 times as effective as fungicides than the copper sulfate standards. Other derivatives, prepared in a similar manner, are being submitted to contractors for testing and evaluation, as for instance, derivatives used in ore-flotation.

This research is continuing.

Publications:

New Products From Fish Oils. III. Preparation and Separation of Fatty Alcohols Made From Fish Oils; Commercial Fisheries Review, April 1957 supplement

New Products from Fish Oils. IV. Preliminary Investigations on Alkyl Halides, Silicones, and Quaternary Ammonium Salts; Commercial Fisheries Review, April 1957 supplement

New Products From Fish Oils. I. Introduction; Commercial Fisheries Review, August 1956

New Products From Fish Oils. II. Polyamino Fatty Acids Derived from Fish Oils; Commercial Fisheries Review, September 1956

(*b*) Determination of structure and analysis of highly unsaturated and saturated acids of fish oils.

Contractor: University of Minnesota, Austin, Minn. (Contract renewed May 1957.)

This program has been concerned largely with the concentration and purification of long-chain, polyunsaturated fatty acids from commercially important fish oils. When the pure fatty acids have been obtained, their chemical and physical properties will be determined. These properties will aid in determining the chemical structure of any given fish oil. The concentration and purification of the fatty acids are being carried out using a combination of low-temperature crystallization, urea crystallization, chromatography, and fractional distillation.

Studies are being performed to show that fish oils resemble animal fats in chemical structure. Much evidence has been obtained to indicate that similar analytical methods used for animal fats can be applied to fish oils. At this time, there is no simple and accurate method for determining the chemical structure of fish oils.

This contract is being continued.

Publications:

Research on Fish Oils at the Home Institute; Commercial Fisheries Review, April 1957 supplement.

Determination of Structure and Analysis of Highly Unsaturated and Saturated Acids of Fish Oils; Annual Report of the Hormel Institute, 1955–56 (published in fall 1956).

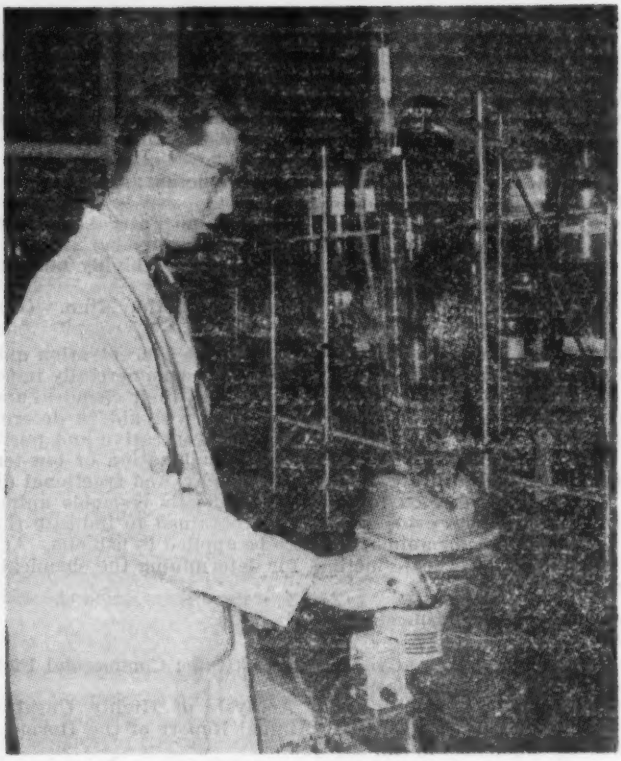
(*c*) Study of the odor problem in fish oils.

Contractor: University of Minnesota, Austin, Minn. (Contract renewed May 1957.)

Work is being carried out to determine the chemical reactions that take place during autoxidation of fish oils that result in the development of undesirable odors during storage. An investigation of the nature of these reactions and the identification of the compounds responsible for these odors may result in providing a solution to the practical odor problem.

Considerable work involved the fractionation of highly oxidized menhaden oil and concentrating the "fish oil" odor components without destroying or changing their chemical structures.

Steam volatile fractions from the oxidized oil were trapped, collected, and analyzed for their chemical constituents. The constituents, identified as carbonyl compounds, are separated chromatographically and identified with carbonyl compounds of known chemical structures.



Fish oil fatty acids are modified by suitable chemical reactions to produce new products.

New chemical methods for separating the odor components are being developed. Spectrophotometric procedures are being used to identify some of the fractionated compounds.

This contract is being continued.

Publications:

Research on Fish Oil at the Hormel Institute; Commercial Fisheries Review, April 1957 supplement.

A Study of the Odor Problem in Fish Oils; University of Minnesota Annual Report of the Hormel Institute, 1955–56 (published in fall, 1956).

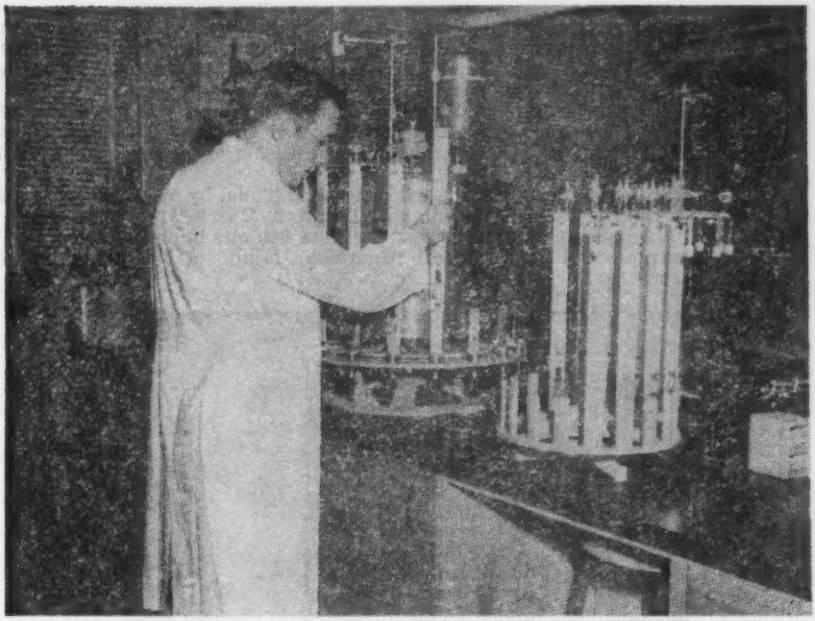
(*d*) Investigations of chemical reactions of fish oil fatty acids.

Contractor: University of Minnesota, Austin, Minn. (contract awarded May 1956. Renewed May 1957).

Chemical reactions of fish oil fatty acids are being investigated with considerable attention being given to reactions at the carbon atom-to-carbon atom double bonds. These double bonds occur in greater numbers in fish oils than in other commercial fats and oils. The products from these reactions will be of potential industrial significance.

Several compounds have been prepared that make use of the double bonds in fish oil fatty acids. Some of these derivatives are presently being evaluated. One type of reaction introduces chlorine or bromine atoms into the long chain molecules in a manner different from conventional halogenations with the result being a compound unique from any others ever made from fatty acids of this kind. Another product results from a reaction of fish oil fatty acids with compounds that have certain chemical similarities of sugar.

This contract is being continued.



Measuring the rate of oxidation of a fish oil in fishmeal. Knowledge of rate and conditions for such oxidation is essential for maintaining quality.

Publications: Research in Fish Oils at the Hormel Institute; Commercial Fisheries Review, April 1957 supplement.

(*e*) Investigation of oxidation of oils in fish meat, fish meal, and processed fish oils.

Contractor: University of California, Davis and Berkeley, Calif., (Contract renewed for fiscal year 1957.)

The natural pigment causing the pink color in normal canned tuna has been chemically identified as a hemochrome compound. It has been shown that by the addition of harmless vitamins (vitamin C and nicotinamide) the formation of this desirable color can be induced during canning of tuna and the color stabilized against subsequent oxidation. Evidence has been obtained that in most if not all cases "green" tuna is caused by alterations in the normal hemetin compounds.

The mechanism of oxidation of fish oils is being investigated. The roles of hematin compounds and of naturally-occurring antioxidants have been extensively studied. Work is just getting under way to extend this research to a study of the role of oxidative enzymes in fish-oil oxidation.

The mechanism of browning in fish, such as occurs when frozen fish rusts or in the formation of brown colors in fish meal during processing and storage, has been investigated. It has been shown that two different types of reactions, a carbonyl amine and an oxidative one are involved, the latter being the predominative factor.

This contract is being continued.

Publications:

Oxidative Deterioration in Fish and Fishery Products. I—Introduction, by M. E. Stansby; Commercial Fisheries Review, April 1957 supplement.

Oxidative Deterioration in Fish and Fishery Products. II—Progress on Studies Concerning Mechanism of Oxidation of Oil in Fish tissue, by W. D. Brown, A. W. Venolia, A. L. Tappel, H. S. Olcott, and M. E. Stansby; Commercial Fisheries Review, April 1957 supplement.

Oxidative Deterioration in Fish and Fishery Products. III—Progress on Investigations Concerning Reactions Resulting in Brown Discoloration, by A. W. Venolia, A. L. Tappel, and M. E. Stansby; Commercial Fisheries Review, April 1957 supplement.

Oxidative Deterioration in Fish and Fishery Products. II—Progress on Studies Concerning Oxidation of Extracted Oils, by E. Einset, H. S. Olcott, and M. E. Stansby; Commercial Fisheries Review, April 1957 supplement.

Identification of the Pink Pigment of Canned Tuna, by W. D. Brown, and A. L. Tappel; Food Research, vol. 22, No. 2, March–April 1957.

(*f*) Study of utilization of derivatives from fish oils in ore flotation. Contractor: University of Minnesota, Minn. (Contract renewed June 1957.)

Collecting iron-ore concentrates from a laboratory ore flotation cell using fish oil fatty acids as the collecting and frothing agents.

Modified fish oil fatty acids under test in flotation process for iron-ore concentration.

Fish oil fatty acids with iodine numbers between 85 and 110 are excellent collectors for iron-oxide minerals; if other uses for the higher unsaturated fish oil fatty acids are found, these intermediate fractions could be adapted to iron-ore flotation.

Recent results have shown that elevated temperatures greatly improve the efficiency of fish oil fatty acids for iron-ore flotation.

Research is continuing toward improving flotation characteristics both of the fish oil fatty acids and of their derivatives which are being prepared at Hormel Institute and in the Fish and Wildlife Service Laboratory at Seattle.

Meantime, research has been started toward adopting fish oil fatty acids to flotation of other nonferrous minerals.

This contract is being continued.

Publications: Utilization of Fish Oils in Ore Flotation, by S. R. B. Cooke and M. E. Stansby; Commercial Fisheries Review, April 1957 Supplement.

(*g*) New uses for fish oils.

United States Fish and Wildlife Service: College Park Technological Laboratory.

Raw materials and processing factors that may influence fish-oil quality are under study in pilot-scale experiments and in commercial plants in an attempt to extend the present market for fish oils through improvements in their quality. Collection of known history oil samples for use of the contractors, and liaison with those engaged in the analyses and utilization studies, is a continuing part of the Service program.

The research is continuing.

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Publications: The Collection and Distribution of Menhaden Oil for Research Use; Commercial Fisheries Review, April 1957 Supplement.

(*h*) Determination of the physical-chemical characteristics of fish-body oils.

Contractor: North Carolina State College, Raleigh, N. C. (Contract renewed June 1956.)

The physical-chemical constants for commercially prepared fish-body oils, collected at different seasons and from different geographical areas, and the correlation of these constants with known raw material and processing variables are intimately related to the development of new or better uses for fish oils.

The iodine value, free fatty-acid content, refractive index, nonsaponifiable matter, saponification number, and Gardner color index have been determined for more than 150 samples of menhaden, tuna waste, samlon waste, sardine waste, and herring oils collected at intervals from June 1956 to May 1957.

The plants producing the oils were located along the Atlantic, gulf, and Pacific coasts, and in the Territory of Alaska. Maximum and minimum values for each variable were within the accepted range except for a few anomalies. These anomalies may have been due to changes in the oils taking place during shipping.

A second portion of the work involves the investigation of the stearine content of the fish-body oils collected during the past fiscal year and also during the previous fiscal year. A great deal of the time was spent in developing suitable methods for the determination of this fraction. The physical nature of this material is also being studied. These methods have been fairly well established and the analytical work begun.

This contract is being continued.

Publications: None.

(*i*) Fundamental study of nonglyceride fractions of fish oils.

Contractor: University of Delaware, Newark, Del. (contract renewed October 1956.)

The nonglyceride fractions of fish-body oils are being studied for their nature and properties as a part of the overall evaluation of fish oils for new uses.

Satisfactory separation of the squalene from the whole nonsaponifiable fraction has now been obtained by chromatographic technique of separation. A good analytical method involving iodimetric titration is now available for squalene analysis.

Squalene has been determined starting with the whole oil, and a value of 0.0857 percent has been obtained. The percentage of squalene in the unsaponifiable fraction is about 5 percent.

Satisfactory methods and analyses have been obtained for the cholesterol content of the nonsaponifiable fraction of the menhaden oil. The nonsaponifiable fraction contains approximately 25 percent cholesterol.

The remaining 70 percent of the nonsaponifiable fraction does not appear to be a single material but a rather complex mixture of several sterols and other nonglyceride substances. Alpha-carotene and gamma-carotene have been separated and positively identified. Quantitative determination of these two substances is under way. In addition, Zeaxanthin, Violaxanthin, and Xanthophyll have been tentatively identified.

This contract is completed.

Publications: None.

(*j*) Study of fish oil insecticides and fungicides for the citrus industry.

Contractor: Florida Southern College, Lakeland, Fla.

A considerable number of compounds prepared from crude fish oil by the contractor, as well as several fish-oil derivatives prepared by the Service's Seattle laboratory, have been screened by laboratory techniques. Pure cultures of *Candida albicans* and other fungus organisms were used for these tests in efforts to develop oil preparations of maximum antifungal activity. Difficulty in ob-

taining fungicidal activity of the desired level, and in identifying or concentrating the active components was encountered so that field testing on plants was quite limited.

Field trials of the fish oil-hydride compounds for nematode control were also inconclusive due to the extreme difficulty of application to roots of growing trees. In the control of either fungi or nematodes the relatively low activity of the fish oil compounds is balanced, in part, by the desirable characteristics of nontoxicity to higher forms of life and the fact that they do not leave undesirable residues in the soil.

This contract is completed.

Publications: None.

(*k*) Use of fish oils in the lubrication of leather.
Contractor: University of Cincinnati, Cincinnati, Ohio. (Contract renewed December 1956.)

Historically, fish oils were used in the conditioning of leather, but this use has declined in recent years. This study is underway to assess the function and value of fish oils, or modification thereof, for this purpose.

The evaluation of leathers fat-liquored with neat's-foot oil and cod-paraffin oil compared to leathers fat-liquored with menhaden oil has been completed. All the leathers were aged for a period of 9 months before testing. The physical-test data indicated many significant differences between neat's-foot oil and menhaden-oil fat-liquored leathers, while between the cod-paraffin oil and menhaden-oil fat-liquored leathers there were only a couple of significant differences. The percentage decrease in grease content was greatest for the menhaden-oil fat-liquored leather and the distribution and penetration of the fat liquors in the aged leathers was rated best for neat's-foot oil, intermediate for menhaden oil, and poorest for the cod-paraffin oil.

In sulfating menhaden oil, a mixture of sulfuric acid and boric acid decreased the temperature of reaction as compared to straight sulfuric acid. The iodine numbers, total acid numbers, percentage of combined SO_3, emulsion stability, liquid homogeneity of sulfated products, and polymerization and discoloration properties of sulfated menhaden oils prepared by sulfuric acid-boric acid, sulfuric acid-phosphoric acid, and straight sulfuric acid were studied. The results of this study favored the sulfuric acid-phosphoric acid system for sulfating menhaden oil.

The evaluation of nonaged and aged leathers fat-liquored with cod oil, neat's-foot oil, and cod-paraffin oil compared to menhaden-oil fat-liquored leather has been completed. The physical test data showed only a few important significant differences between the four fat liquors. The cod oil and menhaden oil fat-liquored leathers showed the greatest decrease in grease content after aging. Before and after aging the distribution and penetration of the fat liquors were, ranked best to least acceptable, (1) cod oil, neat's-foot oil, (2) menhaden oil, and (3) cod-paraffin oil.

The contract is being continued.

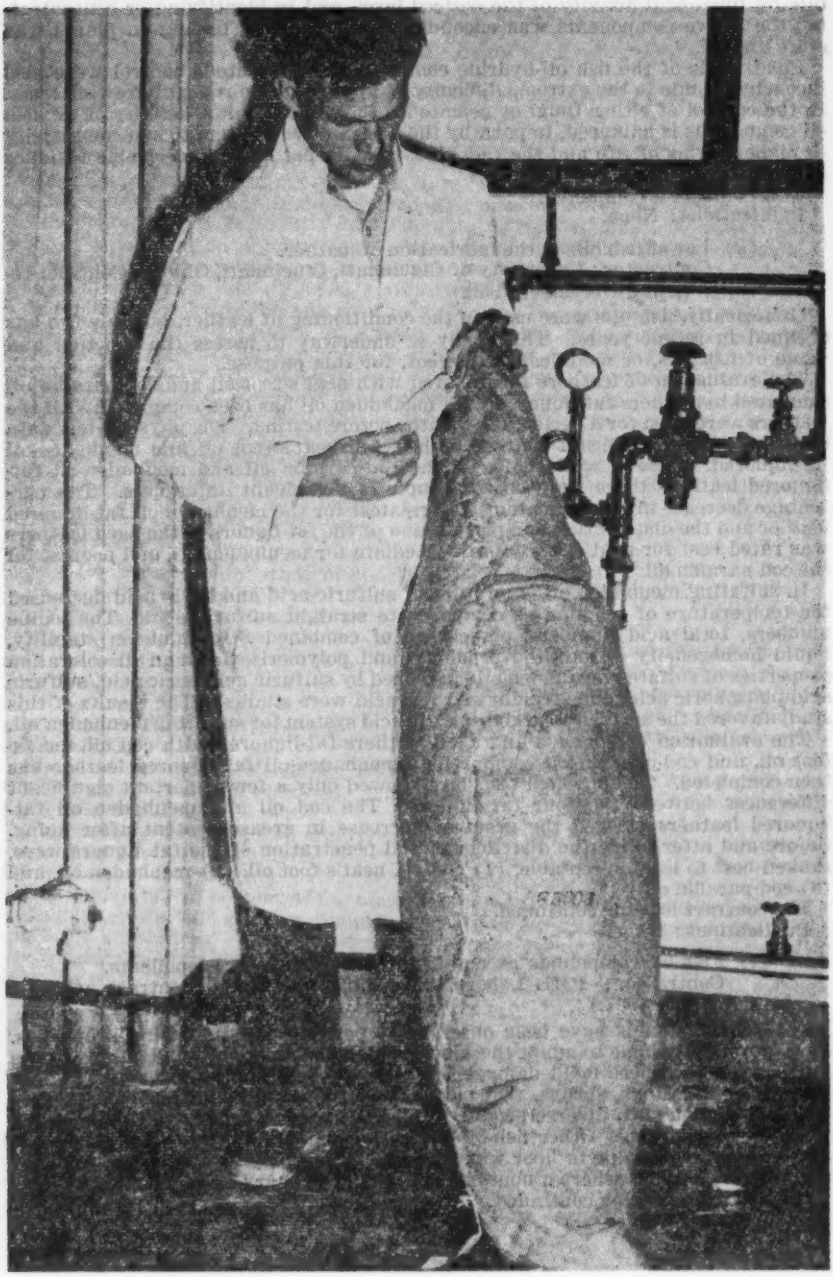
Publications: None.

(*l*) Fish-oil compounds as mold inhibitors and insect repellents.
Contractor: PML Laboratories, Sarasota, Fla. (Contract awarded June 1957.)

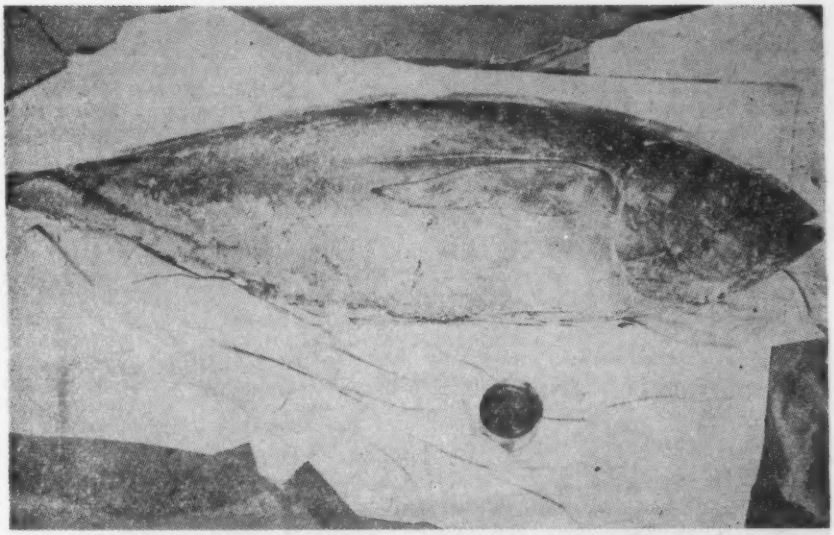
Fish-oil compounds have been observed to possess mold-inhibiting properties. Attempts will be made to adapt these materials to commercial applications in the gulf coast area where mold damage is severe. They will be incorporated into polishes or dressings, sprays, and paints, and the mold-inhibiting effectiveness will be tested on such diverse products as leather goods, asbestos shingles, wood products, and fabrics. Other fish-oil derivatives have insect repellent properties which might be of value in floor waxes, or in sprays for celery, broccoli, cabbage, and other vegetables where a nontoxic spray is of primary importance.

This contract is being continued.

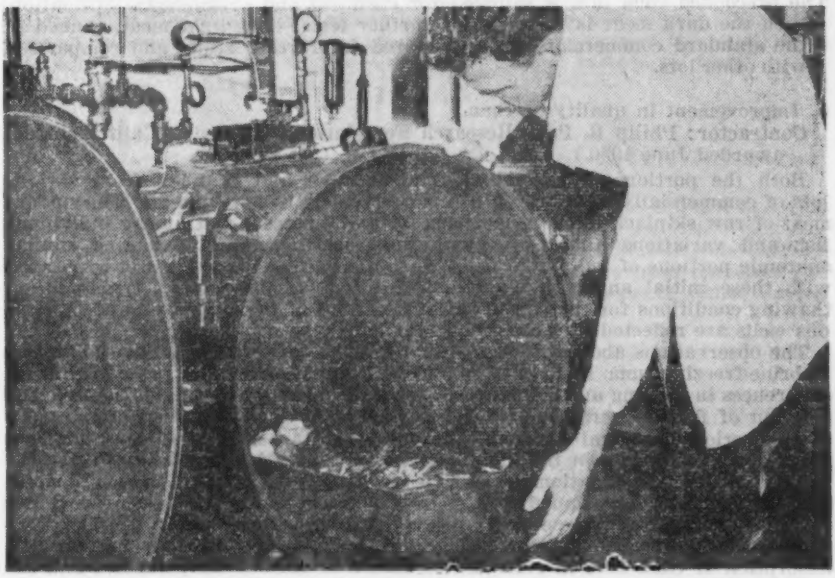
Publications: None.



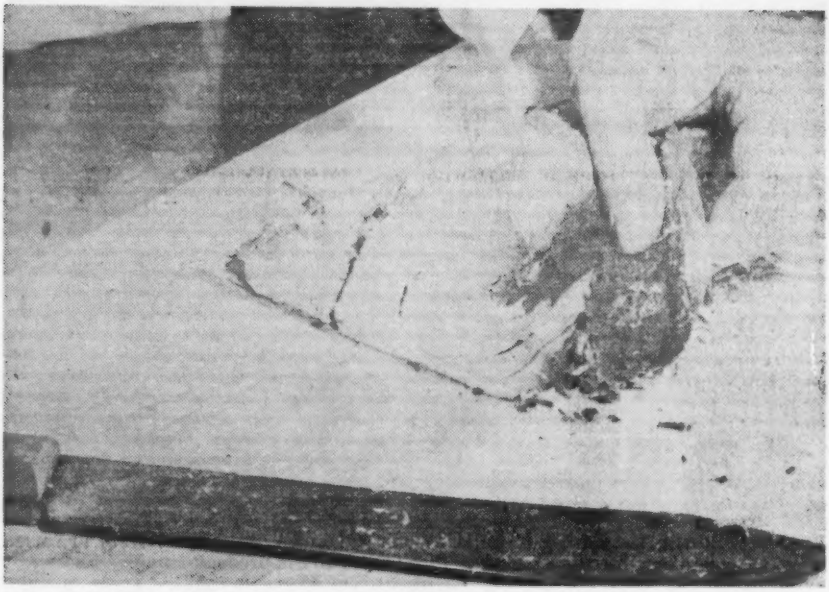
Yellowfin tuna from the Gulf of Mexico wrapped for use as control sample in frozen storage tests. Study is aimed at quality improvement for tuna canning raw material.



Frozen yellowfin tuna from storage. Chemical and organoleptic tests are used to measure quality of the tuna prior to the precook stage.



The yellowfin tuna is removed from the automatically controlled precooking retort. Further examinations are then made to evaluate quality and calculate precook loss in weight prior to the tuna cleaning operation.



The precooked tuna loin is sampled for chemical and organoleptic evaluation, then the dark meat is removed for further tests. The light meat, canned in the standard commercial styles, is stored for further study and comparison with other lots.

5. Improvement in quality of tuna.
Contractor: Philip R. Park Research Foundation, San Pedro, Calif. Contract awarded June 1956.)

Both the portions of individual skipjack tuna and skipjack from various lots of commercially brine-frozen fish varied widely in salt content. The surface meat of raw skipjack loins varied from 0.1 to 4.6 percent salt among individual fish and variations almost as great were encountered in sampling similar anatomic portions of individual fish. The observations aboard vessel correlated with these initial analyses indicate that differences in chilling, freezing, and thawing conditions for the fish in various sections of the brine well and in various wells are reflected in these differences in salt absorption.

The observations aboard the vessel indicated the importance of several factors in brine-freezing tuna, including the effects of handling on deck prior to chilling, differences in chilling and freezing rates in various sections of the brine well, the relation of fish temperature to brine temperature during loading of the wells over a period of several days, and the problem of an excessively slow temperature drop in fish held in the middle of large wells. A preliminary draft of a manual of recommendations for brine refrigeration of tuna was prepared. The tuna industry continued to cooperate actively in the studies in providing suggestions, plant and vessel facilities, and additional personnel.

Shoreside studies on brine freezing and thawing were initiated on the salt absorption of tuna held in refrigerated brines at various temperatures and the later effect of thawing conditions on salt absorption and raw fish quality.

This contract has been extended until August 1957.

Publications: Facts about Freezing the Freshness in Tuna. Pacific Fisherman April 1957.

6. Irradiation preservation of fish and shellfish.
Headquarters: United States Fish and Wildlife Service, Washington, D. C.

One of the most promising peacetime uses of atomic energy is that of irradiation preservation of food through (1) "cold"-sterilization and (2) radiopasteurization. The former destroys all metabolizing bacteria, dormant spores, and systematic enzymes in the food without subjecting the product to thermal proceases. The latter, in a manner analogous to that used on milk destroys all readily

labile metabolizing bacteria. The former promised indefinite storage of food products at room temperature; the latter promises a significant extension of shelflife, especially in combination with other preservation techniques such as refrigerated storage. This very recently begun first year of study will involve a screening of the many products of the fishery industry for the most promising techniques and poducts.

(*a*) Radiopasteurization of fish and shellfish. United States Fish and Wildlife Service: Boston Technological Laboratory.

Very preliminary orientation tests conducted in cooperation with the Quartermaster Food and Container Institute revealed some important factors for consideration in developing radiation preservation for fishery food products. The project was reactivated late in fiscal year 1957 to study the irradiation "pasteurization" of fresh fishery food products to extend their shelf life. The products to be included are cod, whiting, pollock, butterfish, and clams. Fishery products, fresh and pretreated to destroy enzyme activity, will be irradiated at optimum levels to determine the effect on bacteria present on, and the keeping quality of, the product. Attempts will be made to adapt promising methods, if any, to commercial procedures.

This research is being continued.

Publications: None.

(*b*) Radiation preservation of fish.
Massachusetts Institute of Technology, Cambridge, Mass. (Contract awarded April 1957.)

Edible fishery products will be treated with high-voltage cathode rays to destroy bacteria present therein. This treatment in combination with preheating, prefreezing, or prepackaging will be used as a means of extending storage life of fishery food products at refrigeration temperatures above freezing (36° to 40° F.) and when iced at ambient temperatures. The study will include fillets from mackrel, haddock, ocean perch, and lobster meat. Evaluations of the tested products will be made by bacteriological, biochemical, and taste-panel tests.

This contract is being continued.

Publications: None.

(*c*) Radiation preservation of fish.
United States Fish and Wildlife Service: College Park Technological Laboratory.

Studies of the feasibility of extension of shelflife of middle Atlantic and gulf fish and shellfish are underway. Dosage levels sufficient to inactivate bacteria, spores, and enzymes are being used to evaluate effects on palatability and storage life of the products. Shrimp, crabmeat, oysters, and clams from that area are being screened for ability to undergo graduated dosage increments without undue changes in acceptability.

The research is being continued.

Publications: None.

(*d*) Microbiological investigations of fishery products.
Contractor: Maryland State College, Princess Anne, Md. (Contract awarded May 1957.)

The contractor is determining the effect of radiation preservation of crabmeat, oysters, and shrimp on total plate counts, *E. coli*, enterococci, and hemolytic staphylococci contents as well as on the morphology of these microorganisms. The project also includes a study of the microorganisms which may be involved in limiting maximum storage life of other types of irradiated and nonirradiated fishery products under various conditions.

This research is being continued.

Publications: None.

(*e*) Radiation preservation of fish.
United States Fish and Wildlife Service: Seattle Technological Laboratory.

Screening studies are being made to determine those Pacific coast fish and shellfish most adaptable to irradiation preservation procedures. Emphasis is on organoleptic testing and service and liaison to cooperating contractors.

The research is being continued.

Publications: None.

(*f*) Changes in tuna proteins induced by gamma irradiation.
Contractor: Food technology department, University of California, Davis, Calif. (Contract awarded June 1957.)

The purpose of this research is to define the major quality changes in odor, flavor, texture, and color of fish proteins by defining, at the basic chemical level, the changes induced in tuna proteins by gamma irradiation. Definition of the changes in quality at the chemical level is necessary to fully assess the potential of radiation preservation, to provide basic information to judge the wholesomeness of irradiated fish, and to devise methods to prevent any undesirable changes.
This research is being continued.
Publications: None.

(*g*) Preservation of shellfish and smoked fish with ionizing radiations.
Contractor: Food technology department, Oregon State College, Corvallis, Oreg. (Contract awarded June 1957.)

The objectives are (1) to preserve shellfish and smoked fish by low-level ionizing radiations, that, used alone or in combination with conventional methods of processing, will extend the storage life of products and provide products that are acceptable to the consumer; (2) to determine the effectiveness of various processes and of certain additives in minimizing or preventing seafoods from becoming unacceptable due to off-odors or off-flavors.
This research is being continued.
Publications: None.

(*h*) Research on preservation of fish by ionizing radiations.
Contractor: Food, Chemical, and Research Laboratories, Inc., Seattle, Wash. (Contract awarded April 1957.)

Objectives are to determine effectiveness and practicality of fish preservation by radiation. Effect of low levels of radiation on the rate of deterioration of fish during storage and on bacteria responsible for fish spoilage will be determined. Pretreatment, handling, and processing effects on radiation treatment will be studied.
This research is being continued.
Publications: None.

7. Improvement in quality of blue-crab meat.
Headquarters: United States Fish and Wildlife Service, Washington, D. C.

The widespread requests by industry for assistance in the solution of the technological problems involved in the processing of crabmeat as well as the increased severity of the bacteriological requirements established by the several cities and States have led to the inception of a detailed program of study of the problems and processing techniques of the crabmeat industry as well as an organized program of industry assistance and guidance.

(*a*) Blue-crab meat quality investigation; liaison and supervision.
United States Fish and Wildlife Service, College Park Laboratory.

A liaison and supervision unit has been established to insure dissemination to the industry of research information gained, and to guide the program of the research contractor in the direction established as of most urgent need to the industry.
This research is being continued.
Publications: None.

(*b*) An investigation of the cooking, handling, and distribution problems of the blue-crab meat industry.
Contractor: Seafood Processing Laboratory, University of Maryland, Crisfield, Md. (Contract awarded: May 1957.)

The effects of variations in season, geographic area, cooking times and temperatures, cooling procedures, and other processing factors on the yield, quality, and storage life of fresh-picked, chilled, blue-crab meat are being studied. Bacteriological methods will be used to evaluate quality crabmeat shipped in interstate commerce to select or standardize on a single microbiological test of proven consistency and accuracy.
The investigators will visit several times during the investigation all plants in the middle, south Atlantic, and gulf coast areas producing fresh crabmeat. They will study the conditions existing in the industry and its problems and inform the industry of improved techniques and procedures as they are developed.

A set of posters stressing good practices for in-plant use has been prepared for distribution during these visits.

This research is being continued.

Publications: Sanitation posters (distributed to industry).

(*c*) Radiation preservation of eastern-crab meat.

Contractor: Florida State University, Tallahassee, Fal. (Contract awarded: May 1957.)

Fresh crab from nearby plants is being shipped to the Argonne National Laboratory for irradiation at different levels, primarily in the pasteurization range, and is returned to Tallahassee for storage tests. Periodic organoleptic and chemical tests are being made to evaluate the radiation treatments. Pretreatments of various types will be used in an attempt to improve quality and reduce undesirable effects observed as a result of the radiation.

This research is being continued.

Publications: None.

COMMERCIAL FISHERY ECONOMIC STUDIES

1. Survey of fish and shellfish consumption in public eating places. United States Fish and Wildlife Service, Washington, D. C.

Contractor: Bureau of the Census. (Contract awarded May 1955, fiscal year 1955 funds; contract expanded July 1955, fiscal year 1956 funds.)

This study was designed to provide a basis for increasing the sale of fishery products in public eating places by obtaining information on fish consumption in these establishments. Data gathered related to the kinds of species of fish and shellfish consumed, the manner of delivery and storage of supplies, the number of fish and shellfish meals served on various days of the week, the relative profitability of serving fish and shellfish versus meat dishes, the optimum portions and manner of preparation of servings of fish and shellfish, and other topics.

The answers to the individual questions of the Bureau of the Census questionnaire were tabulated and published by the Service as Special Scientific Report, Fisheries No. 218. On the basis of the findings of the sample survey it appeared that almost one-half of all public eating and drinking places in this country did not serve fishery products at the time the survey was conducted. Among other findings were the following:

Six out of ten public eating places serving fish or shellfish sold more dinners priced at $1 or less than at any higher price range. Two out of ten establishments were limited in the use of frozen fish or shellfish by lack of convenient or sufficient storage space. The average inventory in freezer or cold storage was 23 pounds of frozen fish and 26 pounds of frozen shellfish, the average for the establishments with the largest dollar volume being about 16 times greater than the average for all other sales sizes combined. The best ways to promote the consumption of fish and shellfish in public eating places, in the opinion of the respondents, was to feature fish and shellfish specials on the menus or to have the waiter draw the customer's attention to fish and shellfish dishes on the menu.

Regional differences in the consumption pattern of fish and shellfish in public eating places are the subject of a report currently under preparation. From a regional standpoint the following is worth noting:

Proportionally more public eating places serve fish and shellfish in the Northeast and in the West of this country than in the North Central and in the South. In all four regions the price of the most popular dinner is, on the average, cheaper in public eating places serving fish or shellfish than in establishments which do not serve fishery products. Fresh fish and shellfish plays a more important role from a supply standpoint in the case of public eating places in the Northeast than in the case of establishments located in the other regions. In the North Central and South primary reliance is placed on frozen uncooked products. While wholesalers are the more important source of supply of public eating places in all regions, retailers play a bigger part in the supply picture in the Northeast than in the other regions.

Publications: Summary report issued as Special Scientific Report-Fisheries No. 218. Detailed findings by geographic area, size of city, and volume of sales to be issued in additional reports of this series.

2. Survey of the United States shrimp industry.
United States Fish and Wildlife Service, Washington, D. C.

(*a*) The shrimp industry in the United States.

This phase of the project involved a comprehensive survey of supply conditions, production, processing, and distribution of shrimp and shrimp products in the United States. Contracts had been awarded for the study of production costs, vessel efficiency, work practices on fishing craft, processing plant efficiency, primary marketing, and secondary wholesaling and retailing. The contract work was completed in the fiscal year 1956. The United States Fish and Wildlife phase of this project, which was completed in the fiscal year 1957, included the following:

Review of the reports submitted by the contractors to eliminate overlaps, reconciling of differences in the appraisal of facts, and interpretation of the statistical material in the reports of the contractors; writing of the text for two subprojects which had been confined to the presentation of statistical tabulations; construction of an outline, taking into consideration the needs for a well-balanced presentation of all the material in a final report; preparation of material to fill in gaps (material for one-half of the number of chapters in the final report was prepared by the members of the staff); consolidation of all subprojects into one logically organized report. The report was completed and is currently being reviewed by members of the industry.

Publications: Report to be issued as Special Scientific Report-Fisheries.

(*b*) Survey of shrimp fisheries of Central and South America.

Based on a special survey of the local shrimp fisheries by a member of the staff, a report on the supply and production of shrimp (including some data on processing and international trade) south of our border with Mexico was prepared. This report is being edited and readied for publication.

Publications: Report to be issued as Special Scientific Report-Fisheries No. 235 in November 1957.

(*c*) The shrimp industry in overseas countries (other than Latin America.)

A compendium of information on shrimp production in overseas countries obtained from Foreign Service dispatches was prepared by the Service staff. This report too, is currently being edited and readied for publication.

Publications: Report to be issued as Special Scientific Report-Fisheries.

3. Economic survey of distribution of Pacific coast fishery products in Pacific Coast States

Contractor: Oregon State College, Corvallis, Oreg. (Contract awarded June 1955, fiscal year 1955 funds.)

This survey was designed to discover ways and means of improving conditions under which Pacific coast fresh and frozen fishery products are processed and marketed in the Pacific Coast States. The contract was completed; a report is being reviewed by the United States Fish and Wildlife Service staff. Among significant facts uncovered in the course of this survey were the following:

The percentage of west coast consumers of fresh fish is significantly smaller for former residents of the North Central, South Central, and Mountain States where fresh fish are not readily available than for consumers hailing from other parts of the country. However, as people become more familiar with varieties of fresh fish and shellfish as the result of continued residence in areas where fersh products are readily available, these differences in consumption habits tend to disappear. Certain religious and racial groups appear to have a particular preference for fresh fish, while the market for these fish among other groups seems to be relatively small. Thus, large proportions of consumers with an Oriental background or of the Jewish faith seem to favor fresh fish, while only one-fourth of the Mexican households in the sample indicated that they bought fresh fish during the year preceding the survey. Among varieties of fresh fish, salmon and halibut were the most popular species, whereas sole and halibut were most important among the species marketed in the frozen form, and salmon among the species marketed in the smoked form. Lack of availability

of product in the store where the consumer shops appears to hamper the sale of fresh fish to some extent but is a much less important factor in the case of varieties marketed in the frozen form.

Publications: Report to be issued as Special Scientific Report-Fisheries.

4. Study of fishing craft hull and protection and indemnity insurance problems.
Contractor: Boston University, Boston, Mass. (Contract awarded June 1955, fiscal year 1955 funds.)

This study was initiated to shed some light on the high cost of vessel hull and protection and indemnity insurance and to suggest possible means for reducing these costs. The fieldwork on this contract was completed in the preceding fiscal year. Preliminary reports summarizing the data collected on a regional basis were submitted by the contractor. Data on amounts of insurance carried, and premium rates paid, were tabulated for the years 1950 to 1954. Changes in insurance contract provisions were analyzed, underwriting experiences for insured vessels were related to selected vessel and ownership characteristics, and extent of insurance or noninsurance of vessels was determined.

In the course of the study it was found that during the 5-year period covered, approximately 30 percent of active vessels in New England were not insured for hull, and about 32 percent were not insured for protection and indemnity, insurance. In California noninsurance was considerably higher and in the Gulf of Mexico region still higher. In terms of gross premium, hull insurance protection rose from $2,225 to $2,850 per policy during the years 1950–54 in New England, from $1,008 to $1,218 in the Gulf of Mexico region, and averaged from $6,242 during the first 2 years (1950–51) to $6,432 in the last 3 years (1952–54) in California. In terms of coverage, the rise of insurance cost was equally, if not more, important than the rise in gross premium. On the basis of the data collected it was estimated that paid losses and expenses for hull insurance averaged from 71 to 76 percent of earned premiums in New England during the period 1950–54, 74 to 79 percent in the Gulf of Mexico area, and 49 to 54 percent in California. In New England, damages to the hull of the vessel were the most frequent accidents covered by hull insurance, while in California accidents were caused most frequently by damage to machinery and equipment. Among other significant conclusions of this study was the finding that during the period covered general economic conditions as well as the structure of the commercial fishing industry and existing maritime legislation had adversely affected the insurability of vessels.

Publications: The report of the contractor was to be submitted in September 1957. Publication of this report as Special Scientific Report-Fisheries No. 241 is scheduled for January 1958.

5. Economic analysis of freezing fish at sea in the New England fisheries.
Contractor: Northeastern University, Boston, Mass. (Contract awarded May 1955, fiscal year 1955 funds.)

The purpose of this study was to compare the costs of operating the FWS research vessel *Delaware* in freezing haddock at sea with the costs of conventional fishing vessels using ice as refrigerant. The contract was completed in the preceding fiscal year. In view of the technical nature of the report, the findings were submitted to experts from the ranks of industry and to selected Service personnel for critical review. On the basis of the comments thus obtained, a condensed version of the report for popular consumption was prepared. This report is currently being reviewed by the staff.

Publications: Report will be published as a fishery leaflet.

6. Study of use of fish and shellfish in in-plant feeding.
United States Fish and Wildlife Service, Washington, D. C.
Contractor: United States Department of Agriculture, Washington, D. C. (Contract awarded November 1955, fiscal year 1956 funds.)

This project was initiated in conjunction with a survey of in-plant food consumption by the United States Department of Agriculture. Information solicited from establishments catering to employee feeding facilities in industrial plants related to amounts of fish and shellfish utilized and preferences of the caterers for types, packaging, quality, etc., of fish and shellfish supplies procured.

The fieldwork on this contract has been completed by Dun & Bradstreet, Inc., of New York, N. Y., the firm hired by the United States Department of Agriculture to interview the caterers. A report summarizing the statistical findings on fishery items is to be submitted by the contractor by the end of the calendar year.

Publications: Report will be published as a fishery leaflet.

7. Study of inland distribution of fresh fish and shellfish.
Contractor: Boston College, Chestnut Hill, Mass. (Contract awarded June 1956, fiscal year 1956 funds.)

The purpose of this study was to obtain data on the pattern of consumption of fresh (not frozen) fish and shellfish in inland areas as compared with coastal areas. The finding of the survey, it was hoped, would provide some clues as to how consumption of fresh products might be increased in inland areas.

The markets selected for purposes of comparison were Cincinnati, Ohio, and Nashville, Tenn., to represent inland areas, and Portland, Maine, as an example of coastal markets. Field interviews with consumers, retailers, and wholesalers in these 3 cities were completed and the report of the contractor was to be submitted by October 1957.

Publications: The report will be published as Special Scientific Report—Fisheries.

8. Survey of canned fish and shellfish preferences of household consumers, 1956.
Contractor: W. R. Simmons and Associates Research, Inc., New York, N. Y. (Contract awarded June 1956, fiscal year 1956 funds.)

The purpose of this survey was to collect and to develop information on the principal canned fishery products consumed in households in order to provide the Government and the fishing industry with a better understanding of such factors as consumer preferences, buying practices, and distribution of products.

A detailed report was prepared and submitted by the contractor. Among the more important research findings were the following:

Canned fish, the findings indicate, is a product which has found almost universal acceptance in American households. For the country as a whole, about half of the users of canned fishery products might be called "regular" users, i. e., they served them more than 3 times in the 4-week period preceding the interview. Canned fish is not competitive to any considerable degree with fresh and frozen fish. This is explained by the circumstance that canned varieties, tuna, salmon, and sardines, are not widely used in fresh or frozen form in this country. Regionally, the following differences in the pattern of consumption are apparent: the consumption of canned tuna is above the national average in the Northeast and West, and below the average in the central and southern regions of this country. The reverse is true for canned salmon as well as for canned sardines. Tuna was the most widely served canned variety in all sections of the country. In the central and southern regions, its margin of popularity over salmon, though, was less pronounced than in the other two regions. Tuna was considerably more popular than salmon in metropolitan markets, whereas salmon held a slight advantage over tuna in nonmetropolitan communities. Canned tuna was favored to a greater extent by homemakers in the younger age groups, while canned salmon found greater acclaim with homemakers in the older age groups. About 75 percent of all purchases of tuna were of more than one can.

Contract was completed.

Publications: The report was published as Special Scientific Report—Fisheries No. 200. A condensed version of the report was published in the form of an illustrated booklet as circular 45.

9. Study of parity prices and income in the fishing industry.
United States Fish and Wildlife Service, Washington, D. C.

A study of prices and gross income at the fishermen's level was initiated. Construction of price indexes for the more important species and products is planned and parity price series which take into account trends in prices paid by fishermen for commodities and services they buy will be computed for them. Among sources of price data for this study will be the price reports of the Market News offices of the United States Fish and Wildlife Service, as well as data collected by Federal and State data-collecting agencies. Information published by trade journals, local newspapers, and distributor sources will also be used. It is contemplated that the index and parity price data elaborated in the course of this study will be used in the analysis of economic trends and for the presentation of evidence before governmental authorities in connection with testimony on ways and means to improve economic conditions in the industry.

The work on this project is continuing.

Publications: A preliminary report summarizing parity price information for the Pacific-coast area was prepared in dittoed form. Similar reports will be prepared for the gulf coast and Great Lakes areas.

10. Construction of indexes of employment and earnings in the fishing and allied industries.
United States Fish and Wildlife Service, Washington, D. C.

This study was initiated to discover seasonal, cyclical, and secular fluctuations in employment and earnings in the producing, processing, and distributing segments of the fishing industry. The construction of statistically valid indexes must be preceded by extensive research to identify the sources which promise the best results from the standpoint of quality of data collected and convenience and cost of collection. Contact has been made with other Government agencies to establish what data already collected by these agencies could be used for the purposes of this study and to find out to what extent the field staff of other agencies could be employed in gathering data on the fisheries. Similarly, members of the industry have been contacted to obtain an indication of what type of data could be made available to the staff from industry sources for this study.

The work on this project is continuing.

Publications: None.

11. Study of the financial aspects of fish producing, processing, and distributing.
United States Fish and Wildlife Service, Washington, D. C.

This study seeks to obtain data on capital funds invested, return on capital, working capital employed, and working capital ratios in fish producing, processing, and distributing. The success of data collection in this sphere will depend to a large extent on the nature and the amount of information that can be made available to the staff by members of the industry and by firms specializing in financial data reporting. The latter may have to be employed on a contract basis by the Service for these purposes.

It is hoped that the data collected will make it possible eventually to construct indexes measuring changes in capital invested and earnings ratios over time in the different branches of the industry.

The work on this project is continuing.

Publications: None.

12. Study of marketing margins in the fishing industry.
United States Fish and Wildlife Service, Washington, D. C.

This study has as its goal the computation of the producer's share of the consumer's dollar to measure changes in marketing margins over time. The United States Department of Agriculture has been, and is currently, engaged in computing such ratios for the more important agricultural products. It is contemplated that source data gathered by other branches of the Service or already collected for previously described projects (see item 9 above) will be used as statistical raw material for this study.

The work on this project is continuing.

Publications: None.

13. Study of the relative position of the fishing industry in the domestic economy.
United States Fish and Wildlife Service, Washington, D. C.

This study was initiated to provide the industry and the public with materials that can serve as guideposts in formulating plans and policies for the development of fish producing, processing, and distributing activities in this country. To properly assess the relative importance of these activities in the domestic economy selected production, employment, investment, income, and price aggregates will be compared with similar benchmark data for other industries. The data will be collected on a continuing basis to permit trend comparisons. In addition, an attempt will be made to sketch the long-run economic prospects of the industry on the basis of a study of supply and demand factors that will be of principal importance in the production and consumption of fishery products over the next 20 years.

The work on this project is continuing.

Publications: None.

14. Study of the economic effects of controlled fishing in the Pacific coast commercial halibut fishery.
Contractor: University of Washington, Seattle, Wash. (Contract awarded June 1957, fiscal year 1957 funds.)

A contract was awarded to the University of Washington for the purpose of measuring the effects of artificial controls on fishing activities on price and market conditions in the Pacific coast halibut industry. The artificial controls here

referred to may result either from voluntary layovers by fishing vessel owners or may be the direct consequence of regulations issued by the International Pacific Halibut Commission.

The study will involve an examination of records of industry-imposed restrictions and all rules and regulations with regard to gear, area, season, and quota limits on production promulgated by the International Pacific Halibut Commission over the last 25 years. These controls will be related in each instance to data on prices, inventories, turnover, and other marketing factors to discover significant effects.

Contract is continuing.

Publications: None.

15. Study of the demand and price structure for canned tuna; fresh, frozen and canned salmon; fresh and canned oysters; and fresh Atlantic blue crab.
Contractor: Rutgers University, New Brunswick, N. J. (Contract awarded June 1957, fiscal year 1957 funds.)

A contract was awarded to Rutgers University for the purpose of evaluating the principal economic forces affecting prices and utilization of the above specified fish and shellfish products.

Theoretical models of the demand and price structure for the various commodities will be developed and verified by statistical analysis of time series data. Such factors as production, stocks, imports, exports, competing product prices and supplies, and tariff rates will be analyzed to determine their effects on consumption and prices. Use will be made of all existing time series data collected by the United States Fish and Wildlife Service and other Government agencies. In addition, cross-section analyses to the effect of income on consumption based on available survey data collected by Government agencies, universities, and private market research firms will be performed as a check on the income elasticities obtained from the time series analyses.

Contract is continuing.

Publications: None.

16. Economic and biological influences on commercial fish and shellfish production in the State of Maine.
Contractor: Department of Sea and Shore Fisheries of the State of Maine, Augusta, Maine. (Contract awarded June 1957, fiscal year 1957 funds.)

This contract was awarded to find an explanation for the considerable fluctuations in production and marketing activities in the principal fisheries of the State of Mane. The effects of biological, technologcal, and economic factors on these fluctuations will be examined in detail. The discussion will be on a species-by-species basis, the principal species to be considered being clams, lobsters, and sea herring.

Contract is continuing.

Publications: None.

FISHERY EDUCATION AND MARKET DEVELOPMENT

Headquarters: Washington, D. C.

The domestic fishing industry is faced with serious economic pressures which affect each link in the production and distribution chain. Because the marketing of fishery products is conducted on a national and frequently international level, the products of one area may be largely dependent upon markets in other geographical areas. The lower market prices and high inventories of competing protein foods such as meat, poultry, and dairy products, make it increasingly important that the fishing industry increase its efforts to obtain an equitable share of the consumer food dollar. The Service's fishery educational and market development programs are designed as Government aids to assist the industry in solving its marketing problems and improving its competitive status.

These programs are financed entirely by Saltonstall-Kennedy funds. Prior to July 1, 1954, the Section's operations were financed from funds annually transferred to the Secretary of the Interior by the Secretary of Agriculture under the provisions of Public Law 393 (15 U. S. C. 713–3, 76th Cong., Aug. 11, 1939). These former funds and activities are now included in the Saltonstall-Kennedy program.

Since the enactment of the Saltonstall-Kennedy Act, the staff has been expanded to improve the fishery marketing and educational service.

Much of the effectiveness of the program is due to the excellent trade contacts that have been developed. As examples, exhibit space has been donted to the Service for its fishery educational exhibits by the national food trade conventions. Many of the motion pictures that have been produced, or are in production, have been financed by industry segments. Excellent cooperation is received from the food trade associations, the Department of Agriculture, individual State school lunch, restaurant, and institutional personnel and members of the commercial fishing industry.

1. Development of markets for underutilized fish.

Fish and Wildlife Service, Lorain, Ohio, and field.

The marketing of presently nonutilized fish is requiring considerable attention as the populatons of the less popular species increase. At the request of the Lake Erie Fish Management Committee, the Service instituted a rough fish-marketing program August 1, 1955, with headquarters in Lorain, Ohio. Commercial fishermen were reporting that as much as 90 percent of their catch consisted of unmarketable fish which they had to discard by returning to the waters of Lake Erie. As a direct result of the Service's activities, the entire production of sheepshead from Lake Erie during the first half of 1957 has been sold, mainly to mink farms, with some to pet-food canners. Interest in establishing a pet-food cannery on or near Lake Erie has been shown by one large firm in that it has carried on extensive and monthly tests of the various species that are or have not been fully utilized.

The smelt run on the Great Lakes has for years been wasted since markets for human food were not great enough to absorb the entire catch. The fishery-marketing specialists have been working on this so that during the past year, the smelt fishermen were able to sell their entire catch at a profit to both the food market and to the mink-fur farms.

Considerable work has also been done in assisting pet-food canners in locating canning centers in coastal areas where saltwater fish in the rough-fish category are in heavy supply.

The use of ricefields in Arkansas and Texas for the raising of fish, such as buffalo fish and catfish, has posed a problem of marketing the increased output. As a result of the soil-bank program, additional farmers are converting their surplus acreage into fish farms. A preliminary survey by the section early in 1956 showed that around 10,000 acres are already in production with a potential up to 1 million acres. New market outlets, and possibly new products, will have to be developed.

During the past year, assistance was requested from the rice farmers of Arkansas to find a market for the increased production of buffalo fish and catfish in the ricefields. Many field trips and conferences have been held with these farmers who have formed a cooperative to aid them in marketing their fish crop.

2. Development of test kitchen reports and recipes.

Fish and Wildlife Service test kitchens: College Park, Md., and Seattle, Wash.

Increased emphasis has been placed on the development and publication of recipes because of the great need for material on the part of home economists, homemakers, institutional managers, and the general food trade. Tested recipes were developed and prepared for publication in the test kitchens.

Special recipes were developed in homemaker and institutional quantities for use in the special tuna and other promotional programs. In addition, recipes were prepared using shrimp and fish in combination with rice, as part of the Service's cooperative project with the Department of Agriculture rice-promotion campaign. Additional recipes, for use in the school lunchrooms, were also developed in cooperation with the Department of Agriculture. A series of fish and shellfish recipes were developed for use of the Food Service Division of the Army and Air Force and the Quartermaster Food and Container Institute for the Armed Forces.

Publications: The following Test Kitchen Series publications have been released:

How to Cook Halibut;
How to Cook Crabs;
How to Cook Lobsters.

3. Promotion of the use of fish in the school-lunch program.
Fish and Wildlife Service, Washington, D. C. and field.

The school lunchrooms represent one of the largest potential outlets for fishery products. The fishery-marketing specialists in the field devoted the major portion of their time to this activity. Along with the home economists, they conducted a total of 171 statewide fish-cookery demonstrations for 9,000 supervisory school-lunch personnel. About 10 million schoolchildren are served each day by these supervisors, cooks, and managers of school lunchrooms. This represents sales of approximately 2 million pounds of fish (edible weight) per week, if fish is served 1 day a week to these schoolchildren. These demonstrations have been conducted in states as follows:

State	*No.*	*State*	*No.*
Louisiana	9	Wisconsin	4
Virginia	18	New Hampshire	5
Vermont	8	Mississippi	32
Texas	33	Maine	7
Tennessee	20	Georgia	11
Ohio	6	California	8
New York	10		

In addition, 20 demonstrations were presented at school-lunch workshops in the following States: Colorado, Maryland, Minnesota, Utah, Wyoming, Michigan, Massachusetts, Virginia, and Washington. As a result of this demonstration program, new markets for fishery products are being developed, not only at the school level, but also in the home.

4. Promotion of the sale of fish in frozen food locker plants.
Fish and Wildlife Service, Washington, D. C., and field.

The more than 10,000 frozen-food centers or locker plants throughout the country represent an excellent potential outlet for frozen-fishery products, if developed. Due to greater emphasis on special market promotions and to the demonstration program, very few contacts were made by the field staff during this fiscal year. Locker-plant lists which are published by the Service for use as trade promotional material, have been revised for 48 States in the MDL (Market Development List) series.

Publications: 48 State locker plant lists.

5. Educational exhibits at national food conventions.
Fish and Wildlife Service, Washington, D. C., and field.

Efforts not only have been made to encourage the fishing industry to sponsor educational and promotional exhibits at the prominent food trade conventions but the Service regularly sponsors such exhibits to stimulate consumer interest in fishery products. Consulting services and distribution of Service-prepared publications have been included with the exhibits. The conventions at which the Service regularly exhibits ars as follows:

National Restaurant Association.
National Fisheries Institute.
American Dietetic Association.
American School Food Service Association.
National Frozen Food Locker Institute.
American Home Economics Association.
National Frozen Food Convention.

In addition to these national conventions, the Service had an exhibit at the Astoria, Oregon, Seafood Festival and at the Illinois State Restaurant Association convention.

6. Production and distribution of fishery educational motion pictures.
Fish and Wildlife Service, Washington, D. C.

(*a*) Production: The fishery educational motion pictures produced by the Service are financed by funds voluntarily supplied by industry, or from the Saltonstall-Kennedy funds. All of the films undertaken are produced under close Service supervision, using commercial motion-picture production facilities.

One Service-financed film was produced and made available for distribution during the year: Fresh Out of the Water; 16 millimeter, color, sound; depicting the proper handling and marketing of fresh fish.

The shooting of one industry financed motion picture was completed during the year. This picture is Sardines from Maine—Down-East Style, and is financed by the Maine Sardine Industry, Augusta, Maine. Provision is being

made so that short sections can be used on television. Estimated completion date, August 1957.

Contracts have been made for two new films to be financed by S–K funds. The tentative titles are: Outdoor Fish Cookery and Fish for Sale. The former will depict various local ways of cooking fish in the outdoors and will show such methods as a salmon barbecue, oyster roast, and catfish fry. The second film will use the hidden camera technique of housewives buying the various types of fish and will try to answer such questions as why does she buy a particular species and why does she buy it on a certain day of the week.

(*b*) Distribution: The fishery educational motion pictures are being distributed nationwide on a free-of-charge basis through 140 cooperating film libraries. In addition, public service TV showings provide for extensive distribution. Each of the Section's fishery-marketing specialists have been supplied with projectors and prints of all films for training and public relations showing. Approximately 2,500 prints of fishery educational motion pictures are now in distribution and it is estimated that these films were viewed by nearly 1 million persons last year, exclusive of the TV showings.

Publications: Fishery Leaflet 438, Fishery Motion Pictures.

7. Special marketing programs.
Fish and Wildlife Service, Washington, D. C., and field.

Several industry-Government cooperative sales promotion campaigns have been conducted with additional programs scheduled for the summer and fall of 1957. In each instance, the full staff and services of the Educational and Market Development Section have been assigned to stimulate sales through the school-lunch programs, public and private institutions, including national, regional, State, and local restaurant associations, chainstores, food trade associations, the radio, television and press food editors, fishery trade associations, and the promotional outlets of the United States Department of Agriculture. Public service television demonstrations by Service home economists and the fishery-marketing specialists also play an important role in these programs.

Programs conducted in fiscal year 1957 were as follows:

National Tuna Week.
National Fish Week.
Wisconsin Fish Week.
California Fish Week.
Lent.

The effectiveness of promotion was tested in three cities, Portland, Maine, Cincinnati, Ohio, and Nashville, Tenn., by means of a special fresh-fish promotion. The results of this spot check are forthcoming.

Programs planned for the summer and fall of 1957 are:

National Canned Salmon Week.
National Fish Week.
National Tuna Week.

Publications: Promotional leaflets.

8. Florida fish-marketing survey.
Contractor: University of Miami, Coral Gables, Fla.
(Awarded October 1954, fiscal year 1955 funds.)

A contract was let to the Marine Laboratory, University of Miami, to conduct a marketing study of the mullet fishery in Florida.

A report containing a number of recommendations for improving the mullet marketing situation resulted from this survey. Inasmuch as this is basically an industry problem the recommendations are directed toward industry action.

Contract completed.

Publications: None.

9. Radio, press, and television promotion of fishery products.
Fish and Wildlife Service, Washington, D. C.

The mailing list of food releases for use by home economists, dietitians, extension demonstration agents, and food editors of newspapers, television, radio, and food trade organizations now totals approximately 1,900. The releases which are on a biweekly schedule contain recipes and consumer hints and guides on the fishery products which are in best supply at the time.

In connection with the special marketing programs, special recipes, fact sheets, and photographs are prepared and distributed to the food editors. Participation on public service radio and television programs to encourage the increased use

of fishery products, is an expected function of the home economists and the field representatives as a supplemental phase of their field activities. This phase of the program is particularly stressed during the special marketing programs.

Publications: Biweekly food releases.

10. Preparation of marketing aids.
Fish and Wildlife Service, Washington, D. C.

Market development bulletins, advising the industry of marketing possibilities and stressing the need for improved marketing practices, have been issued through the Market News Section's daily reports and reprinted to a great extent in trade periodicals. These bulletins are scheduled for weekly release and cover such subjects as new developments in production, processing, marketing, and consumption of fishery products. A recipe folder for use in various market promotion programs has been prepared for distribution at point of sale.

Publications:

Market Development Lists of locker plants in individual States).
Daily Market News Reports (weekly market development bulletins).

11. Forecasts of fishery products supply.
Fish and Wildlife Service, Washington, D. C.

The quarterly publication of Commercial Fisheries Outlook has been continued with improved coverage and revisions. This report is designed to meet the growing interest in the marketing of fishery products and contains an analysis of expected future markets and the supply and demand situation. The Outlook report reflects a combination of opinions of representative industry members and interpretations of past experiences as related to Government and other available economic data.

The project is being continued.

Monthly forecasts of the availability of fishery products are also supplied to the Department of Agriculture for use in the preparation of its monthly list of foods in plentiful supply, to the National Restaurant Association, and to a number of other national food trade groups.

Publications:

Commercial Fisheries Outlook (quarterly).
Fish and Shellfish Supplies (monthly forecast for National Restaurant Association, food editors, and food trade associations).

12. Commercial Fisheries Abstracts.
Fish and Wildlife Service, Seattle, Wash., and Washington, D. C.

The coverage of this monthly technological journal was broadened to cover additional technological and trade periodicals. Permission was received from the Bureau of the Budget to increase the printing of 2,000 copies to meet standing requests. The editorial staff was strengthened, and format and editoral revisions were made.

Publications: Commercial Fisheries Abstracts (monthly).

13. Development and expansion of foreign markets for fishery products.
Fish and Wildlife Service, Washington, D. C.

Although the United States has converted from an exporting to an importing nation as far as fishery products are concerned, certain segments of the domestic industry are economically reliant upon foreign markets. This is particularly true of the menhaden oil industry, as the bulk of its sales are to Western Europe. With the increased world production of vegetable and other oils such as cottonseed, soybean, coconut, and palm, the foreign consumers are becoming more selective in their purchases. In order to apprise the domestic industry of the trends and new developments and quality requirements in the foreign markets, arrangements were made for a qualified oil expert of the Department of Agriculture to survey these markets under the Service's technical supervision. Reports of the survey, which terminated July 1, 1956, included Norway, Sweden, Denmark, Western Germany, the Netherlands, Belgium, France, and the United Kingdom, and were released in 1957.

A special survey of market outlets for canned sardines packed in the United States was conducted in cooperation with the Department of Commerce and the State Department in 30 countries. The reports were distributed to interested canners as soon as received, and also appeared in the daily market news reports and in Commercial Fisheries Review. A similar survey was made in 15 foreign countries on the market possibilities for American produced canned mackerel.

Publications: Through the Daily Market News Reports and Commercial Fisheries Review.

14. Cooperation with State educational departments.
Fish and Wildlife Service, Washington, D. C., and field.

With the additional field staff, it has been possible to develop and expand contacts with the State school lunch officials to a considerable degree. This has been especially beneficial during the special marketing programs, where the cooperation of school lunch directors, in all of the States, has been very important.

Since the passage of Public Law 1027 (84th Cong.) consultation service, in the form of background information, has been increasing in view of a bill to provide for the training of needed personnel in the fishing industry.

Contacts also were made with leaders and students of a 4–H fishing club in Rockland, Maine, and at Ketchikan, Alaska. This may be a probable forerunner of a number of similar clubs in other fishing areas. No funds were appropriated in fiscal year 1957 or 1958 for part I of Public Law 1027 for the training of college level, but funds for part II (vocational training) were approved for fiscal year, 1958

15. Handling of emergency demand and supply situations.
Fish and Wildlife Service, Washington, D. C., and field.

The cooperative regional efforts between Government and industry have assisted greatly in balancing some of the more critical localized demand and supply situation. Some of these, such as the Alaska shrimp and Dungeness crabs, found markets in other regions. Our field agents developed a substantial market in Chicago for Alaska shrimp, and our field agents in Seattle and Jacksonville developed a market in Florida for Dungeness crabmeat.

Canned Pacific mackerel was the subject of considerable attention in the regular school lunch demonstrations in Southern States.

Royal Red Shrimp discovered by the Service's exploratory fishing activities in 1950 was introduced on the market this year with encouraging succes. While the supply and trade channels are still somewhat uncertain, the prices paid for Royal Red Shrimp were somewhat higher than for white shrimp and helped offset the higher cost of production.

The consulting assistance rendered to the Florida mullet industry this year was continued.

During the Hungarian revolt, large numbers of refugees were fed by various international relief agencies. The possibility of marketing some of our domestic fishery products, such as canned mackerel, for feeding the refugees, was explored. Due to food habits and cost, is was not possible to dispose of any American produced fishery products.

COMMERCIAL FISHERY STATISTICS

1. Release of State and National statistical reports.
Headquarters: Washington, D. C.

Fishery statistics are required for effective management and proper use of our fishery resources. Information on employment in the fisheries, the volume and value of the catch, production of manufactured fishery commodities, freezings and cold-storage holdings, data on foreign trade in fishery products, and related information is the foundation of our knowledge concerning the fisheries.

The fishing industry and the governmental agencies concerned with the fisheries are particularly dependent upon statistical information. The industry is widely scattered, extending over thousands of miles of coastline and along the waters of the interior. A large portion of the catch is taken by small independent fishermen, and much of it is sold through small dealers who have little contact with other segments of the fishing business. With over 200 species of fish and shellfish taken commercially and with the numerous manufactured products prepared from these various species, it is impossible for any person or agency to follow trends in the fisheries without adequate statistical data. Collection of more complete fishery data and earlier release of the information will assist management officials in maintaining the fisheries and will aid Government and industry in making the best use of the resource.

(*a*) Publication of monthly and annual statistical bulletins and the annual Statistical Digest.
Fish and Wildlife Service, Washington, D. C.

Monthly bulletins containing data on landings of fishery products continued to be issued earlier than was previously possible, and additional annual bulletins on the landings in the various States are being issued. Monthly landings

bulletins for South Carolina were released for the first time during the year, and arrangements were made for publication of a similar bulletin for Louisiana. The 1956 edition of Fisheries of the United States and Alaska, a preliminary review (Fishery Leaflet 393) was expanded to include current information on additional phases of the fisheries. For the first time in this report, a breakdown was shown on the United States catch of fish and shellfish used separately for food and for industrial products for the years from 1921 to 1956. A tabulation which was included indicated that current catch data are now available on 92 percent of the United States and Alaskan catch.

Preparation of Fishery Statistics of the United States for 1955 is being expedited so that the report can be sent to the printer several months earlier in the year than the previous year's report. Completion of surveys has been arranged so that the 1956 edition of Fishery Statistics of the United States will likewise be released several months earlier than the 1955 edition.

The collection and publication of fishery statistics is a continuing activity.

Publications:

Fishery Leaflet 393, Fisheries of the United States and Alaska, 1956, A Preliminary Review.
C. F. S. No. 1517, Canned Fish and Byproducts, 1956.
C. F. S. No. 1518, Packaged Fish, 1956.
C. F. S. Nos. 1307, 1380, 1413, and 1470, Fish Stick Report.
Statistical Digest No. 39, Fishery Statistics of the United States, 1954.

2. Regional statistical surveys.
Headquarters: Washington, D. C.

Summaries of fishery statistics are required to indicate national trends in employment, volume of the catch, production of manufactured products, and related information. However, data of most value to management officials, research workers, and often to members of the industry are detailed statistics concerning local fisheries. This is true since these data supply information not apparent in regional or national summaries. To provide this information it is necessary that detailed statistics be assembled by gear and area of capture, fishing effort expended, port of landing, etc., on the fisheries of the various States. The collection and tabulation of these data must be performed so as to provide information that can be used in arriving at regional and national summaries. Since there is wide variation in the fishery data collected by the various States, it is necessary that the Fish and Wildlife Service statistical canvasses be adapted to make full use of States figures and still provide comparable data for all areas.

a. General statistical survey of the Atlantic Coast States.
Fish and Wildlife Service: Field Stations, Providence, R. I.; Annapolis, Md.; Beaufort, N. C.; Charleston, S. C.; Brunswick, Ga.; and Coral Gables, Fla.

The collection of data on employment in the fisheries, the quantity of gear, number of craft, and data on the volume and value of the catch of fishery products has been speeded up along the entire Atlantic Coast. Data on the fisheries of that area will become available several months earlier than in previous years, which will permit earlier publication of the Service's sectional bulletins and the annual Statistical Digest.

In addition to the publication of monthly bulletins on landings of fishery products in Rhode Island, North Carolina, and Georgia—which were undertaken as a result of the availability of Saltonstall-Kennedy funds—release of a bulletin containing data on landings in South Carolina was undertaken beginning with January 1957.

The collection of detailed data on landings of shrimp in each of the South Atlantic States was undertaken in July 1956. Information on this catch is included in the monthly shrimp landings bulletin.

The collection and publication of fishery statistics is a continuing activity.

Publications:

Rhode Island Landings, monthly and annual.
North Carolina Landings, monthly and annual.
South Carolina Landings, monthly and annual.
Georgia Landings, monthly and annual.

(*b*) General statistical survey of the Gulf States.
Fish and Wildlife Service: Field stations: Key West, Fort Myers, Tampa, Apalachicola, Fla.; Cedar Point, Ala.; Ocean Springs, Miss.; New Orleans, Port Sulphur, Houma, Galiano, and Berwick, La.; and Galveston, Freeport, Aransas Pass, and Brownsville, Tex.

Collection of operating unit and catch statistics in the Gulf States is being accelerated, and detailed information on the important shrimp fishery is being collected. Publication of a monthly bulletin containing data on the landings of shrimp in the gulf area was started in January 1956. The bulletin contains landings and dockside value by species and size, by States, and a summary of the catch by areas in the Gulf of Mexico. Additional detailed information showing the catch by species and size, by depth of water, fishing time, and area of capture is also assembled for the use of Service and State biologists. Copies are also made available to members of the industry, upon request.

An annual bulletin containing summary information on fishing effort expended and the catch, by species, size, area of capture, and State in which landed by months has been released.

This is a continuing activity.

Publications:

Shrimp Landings, monthly and annual.
Gulf Coast Shrimp Catch, by Area and Depth, monthly and annual (distribution is limited to State and Federal fishery personnel and members of the industry having specific need for the data).
Louisiana Landings, monthly and annual.

(*c*) Bait-shrimp survey of Galveston, Tex., area
Fish and Wildlife Service field stations.

In recent years, there has developed in the Gulf States an important fishery for the taking of live shrimp for use as fish bait. Preliminary surveys indicate that the catch of live- and dead-bait shrimp amounts to many millions of pounds and must be taken into account in biological studies of the resource. In order to accurately appraise the importance of the fishery and to obtain needed biological data on the catch, funds were made available for the last 2 months of fiscal 1957 and for fiscal 1958 to conduct a detailed statistical survey of the bait-shrimp fishery in the Galveston area. A study of the data obtained is expected to indicate whether the shrimp statistical program should be expanded to obtain similar data in other areas, and the feasibility of collecting data on the bait fish by sampling procedures.

The project will continue through fiscal 1958.

(*d*) General statistical survey of the Pacific Coast States.
Fish and Wildlife Service field stations.
Astoria, Oreg., and San Pedro, Calif.

Current information on receipts of fishery products at Astoria, Oreg., was collected during the year, and arrangements were made to have the Service's employee stationed at Astoria handle a considerable portion of the collection of data on employment, catch, and the production of manufactured fishery products in Oregon so as to speed up the publication of data on the fisheries of that State. A monthly bulletin is now being released on landings of fishery products in California by species for each of six coastal regions, and arrangements have been made for the preparation of more detailed tabulations on the California catch of fish and shellfish by gear of capture, and on employment in the fisheries.

This is a continuing activity.

Publication: California Landings, monthly.

(*e*) General statistical survey of the Mississippi River and Great Lakes States, and of the international lakes of Minnesota.
Fish and Wildlife Service: Field stations, Northville, Mich.; La Crosse, Wis.; and Vicksburg, Miss.

A survey of the operating units employed in the fisheries of the Great Lakes and the ninth canvass in history of the Mississippi River and its tributaries have been undertaken. Collection of these data, with information assembled for coastal areas, will provide complete information on the commercial fisheries of the entire United States. Complete and continuing annual employment and catch surveys of both the Great Lakes and Mississippi River areas are being conducted for the first time.

Publication of a monthly cooperative Service and State of Ohio bulletin on the landings of fishery products taken in Lake Erie began with data for the month of March 1956. This is the first monthly landings bulletin for the Great Lakes area.

This is a continuing activity.

Publications:

Ohio Landings, monthly and annual.
C. F. S. No. 1515, Lake Fisheries, 1955.
C. F. S. No. 1541, Mississippi River Fisheries, 1955.

FISHERY MARKET NEWS SERVICE

1. Frozen and canned fishery products market coverage.
   Fish and Wildlife Service, Washington, D. C., and Market News Service field offices.

Plans for more complete periodic market and price reports on domestic and imported frozen and specialty fishery products and canned fish and shellfish are being formulated. The almost weekly appearance of new frozen specialty products on the market requires more contacts in order to adequately cover the marketing of fishery products at principal processing and distribution centers. This type of information is important in gaging the marketing trends of fishery products.

Overall summary periodic reports of a specific product, a number of related products, or a fishery just prior to the start of a new season or at the end of a season are planned. These reports would be a compilation of available data on landings, receipts, prices, market conditions, and trends for the past few years. These reports can be used to study the trends and, thereby, more intelligently plan operations for a new season.

Collection of production and pack data for important frozen packaged fish and canned fish in principal packing centers not now covered is planned. For example, cold-storage data on fish sticks do not reflect actual conditions since many processing plants now have freezing facilities in their packing plants and do not have to utilize cold-storage plant facilities for freezing. Therefore, some method of including the actual freezings of fish sticks in cold-storage reports is being devised.

More detailed periodic data on imports on a daily or weekly basis is planned for important importing areas. Because imports are increasing and competition from imports is becoming keener, current data is of considerable value in gaging the market for fishery products.

Shrimp landings at principal gulf ports are now being reported by species and sizes, and it is planned to also report ex-vessel prices at selected ports as soon as plans for collecting this information have been completed.

Reporting on trends in foreign fisheries of specific interest to the United States fishing industry has been expanded. More of the reports from foreign posts are being abstracted and published in Market News' daily Fishery Products Reports.

Publications:

Halibut Market Developments at Chicago, 1954–56.
Seattle Ex-Vessel Halibut Prices, 1953–56.
Seattle Salmon Exchange Troll Salmon Prices, 1955–56.
Alaska Ex-Vessel Halibut Prices, 1955–56, and Alaska Troll Salmon Ex-Vessel Prices, 1955–56.

Other data is published in the Fishery Products Reports issued daily by the Market News Service field offices and in Commercial Fisheries Review, the Service's monthly periodical issued from Washington, D. C.

2. Marketing of fishery products.
   Headquarters: Washington, D. C.
   Contractor: A. J. Wood & Co., Philadelphia, Pa. (Awarded June 1955, fiscal year 1955 funds.)

A study of fishery products marketing in Philadelphia, Baltimore, Atlanta, Houston, St. Louis, Minneapolis-St. Paul, Cleveland, and Detroit was made to (1) determine local consumption of and marketing practices for fresh, frozen, canned, and cured fishery products; (2) obtain background information for the orderly expansion of current fishery market news reporting; and (3) ascertain the possibilities of expanding the distribution of fishery products in those areas.

Fieldwork was completed in December 1956. Due to lack of fishery background and, in some instances, lack of industry cooperation, completion of fieldwork by the contractor was delayed. Final reports have been submitted by the contractor, and are being edited for publication.

Publications: Summaries of the reports will be published in Commercial Fisheries Review, the Service's monthly periodical.

APPENDIX I

THE ACT AND ITS HISTORY

The Saltonstall-Kennedy Act (appendix II) made available to the Secretary of the Interior for each fiscal year "* * * beginning with the fiscal year commencing July 1, 1954, and ending on June 30, 1957," 30 percent of the gross receipts from duties collected under the customs laws on fishery products. These moneys are to be maintained in a separate fund and used by the Secretary of the Interior "* * * to promote the free flow of domestically produced fishery products in commerce by conducting a fishery educational service and fishery technological, biological, and related research programs * * * and to develop increased markets for fishery products of domestic origin and to conduct any biological, technological, or other research pertaining to American fisheries." The act limited the annual expenditure from this fund to $3 million and provided further that the balance of the fund which shall be available until expended, shall not exceed $5 million at the end of any fiscal year. Effective with the fiscal year ending June 30, 1957, the Saltonstall-Kennedy Act was amended by section 12 of Public Law 1024, 84th Congress, 2d session, approved by the President on August 8, 1956, commonly called the Fish and Wildlife Act of 1956 (appendix III). Subsection 12 (a) of this law makes the Saltonstall-Kennedy Act permanent, and subsection 12 (b) removes the $3 million limitation on annual expenditures, making available annually hereafter the full 30 percent of the duties on imported fishery products and the funds which accrued heretofore.

The act was first introduced in the Senate as S. 2802, 83d Congress, 2d session, by the Honorable Leverett Saltonstall and the Honorable John F. Kennedy in behalf of themselves and 26 other Senators. Hearings were held by the Senate subcommittee of the Committee on Interstate and Foreign Commerce on April 1, 1954. On April 14, 1954, the full Committee on Interstate and Foreign Commerce submitted report No. 1210 (Calendar No. 1216), recommending passage of the bill. Senate debate on the bill is recorded on May 14, 1954, and it was passed on that date.

In the House of Representatives, the bill was referred to the Committee on Merchant Marine and Fisheries. The Subcommittee on Shellfish and Salt Water Fisheries had held hearings on April 2 and 3, 1954, on companion bills H. R. 4303, 5829, 7441, 7641, and 7671. The full committee submitted report No. 1770 on June 8, 1954, recommending passage of S. 2802, as passed by the Senate. The bill was debated on the floor of the House on June 17, 1954, and passed the same date. The President approved the legislation July 1, 1954, as Public Law 466, 83d Congress, chapter 447, 2d session. It is now cited as the act of July 1, 1954 (68 Stat. 376).

The Saltonstall-Kennedy Act is an amendment to section 2 of the act of August 11, 1939 (53 Stat. 1411). This act (appendix IV), provided for a transfer of $75,000 from the Secretary of Agriculture to the Secretary of the Interior to promote the free flow of domestically produced fishery products in commerce by conducting a fishery educational service, and $100,000 to develop and increase markets for fishery products of domestic origin. The act of August 11, 1939, also authorized the Federal Surplus Commodities Corporation to purchase and distribute surplus products of the fishing industry and made available $1,500,000 per year from the funds created under and to carry out the provisions of section 32 of the act of August 24, 1935 (49 Stat. 774), for this purpose (appendix V). Listed below for the fiscal year 1941 through 1954 are shown the funds transferred by the Secretary of Agriculture to the Secretary of the Interior to promote the free flow of domestically produced fishery products in commerce by

conducting a fishery educational service and to develop and increase markets for fishery products of domestic origin, as authorized by the act of August 11, 1939 (53 Stat. 1411).

Fiscal year:	*Amount*	Fiscal year—Continued	*Amount*
1941	$25,000	1948	175,000
1942	25,000	1949	160,000
1943	37,500	1950	175,000
1944	37,500	1951	175,000
1945	45,000	1952	160,000
1946	45,000	1953	173,000
1947	70,000	1954	175,000

The funds now available annually under the terms of the Saltonstall-Kennedy Act, as amended, include the $175,000 formerly made available under the terms of the act of August 11, 1939.

The act of August 24, 1935, did not provide any funds for the Secretary of the Interior to conduct fishery educational and market development activities or for the purchase of surplus fishery products. Other provisions of legislation on the subject of diverting surplus fishery products from the normal channels of trade and commerce were contained in the act of May 25, 1938 (appendix VI), the act of April 12, 1937 (appendix VII), and in the act of March 5, 1937 (appendix VIII). These were essentially the same as those already quoted above. Under the authorizations cited, the Federal Commodities Corporation purchased fishery commodities for distribution to relief clients in the years and in the amounts as follows:

Surplus fish purchases by Federal Surplus Commodities Corporation

Year of purchase	Amount	Value
	Pounds	*Dollars*
Fiscal year 1937	12,059,000	297,000
Fiscal year 1938	3,595,000	265,000
Fiscal year 1939	None	None
Fiscal year 1940	382,000	22,300

NOTE.—No purchases of surplus fishery products have been made under the terms of the Saltonstall-Kennedy Act.

APPENDIX II

[PUBLIC LAW 466—83D CONGRESS]

[CHAPTER 447—2D SESSION]

S. 2802

AN ACT To further encourage the distribution of fishery products and for other purposes

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That section 2 of the Act of August 11, 1939 (53 Stat. 1411), is hereby amended to read as follows:

"SEC. 2. (a) The Secretary of Agriculture shall transfer to the Secretary of the Interior each fiscal year, beginning with the fiscal year commencing July 1, 1954, and ending on June 30, 1957, from moneys made available to carry out the provisions of section 32 of such Act of August 24, 1935, an amount equal to 30 per centum of the gross receipts from duties collected under the customs laws on fishery products (including fish, shellfish, mollusks, crustacea, aquatic plants and animals, and any products thereof, including processed and manufactured products), which shall be maintained in a separate fund and used by the Secretary of the Interior (1) to promote the free flow of domestically produced fishery products in commerce by conducting a fishery educational service and fishery technological, biological and related research programs, the moneys so transferred to be also available for the purchase or other acquisition, construction, equipment, operation, and maintenance of vessels or other facilities necessary for conducting research as provided for in this section, and (2) to develop

and increase markets for fishery products of domestic origin and (3) to conduct any biological, technological, or other research pertaining to American fisheries.

"(b) For the purposes of this section, any agency of the United States, or any coroporation wholly owned by the United States, is authorized to transfer, without reimbursement or transfer of funds, any vessels or equipment excess to its needs required by the Secretary of the Interior for the activities, studies, and research authorized herein.

"(c) In carrying out the purposes and objectives of this section, the Secretary of the Interior is directed as far as practicable to cooperate with other appropriate agencies of the Federal Government, with State or local governmental agencies, private agencies, organizations, or individuals, having jurisdiction over or an interest in fish or fishery commodities and he is authorized to appoint an advisory committee of the American fisheries industry to advise him in the formation of policy, rules and regulations pertaining to requests for assistance, and other matters.

"(d) The Secretary of the Interior is further authorized to retransfer any of the funds not to exceed $1,500,000 to be made available under this section to the Secretary of Agriculture to be used for the purposes specified in section 1 of this Act, and only such funds as are thus transferred shall be used for the purposes specified in section 1 of this Act with respect to domestically produced fishery products.

"(e) The separate fund created for the use of the Secretary of the Interior under section 2 (a) of this Act and the annual accruals thereto shall be available until expended, except (1) that not more than $3,000,000 be spent in any fiscal year and (2) that the balance of the fund shall not exceed $5,000,000 at the end of any fiscal year, and the Secretary of the Interior shall retransfer the funds in excess of said $5,000,000 balance to the Secretary of Agriculture to be used for the purposes specified in section 32 of the Act of 1935 (49 Stat. 774; 7 U. S. C. 612c), as amended.

"(f) The Secretary of the Interior shall make a report to the appropriate committees of Congress annually on the use of the separate fund created under section 2 of this Act."

Approved July 1, 1954.

APPENDIX III

Section 12

[PUBLIC LAW 1024—84TH CONGRESS]

[CHAPTER 1036—2D SESSION]

S. 3275

FISH AND WILDLIFE ACT OF 1956

SEC. 12. (a) The authorization for the transfer of certain funds from the Secretary of Agriculture to the Secretary of the Interior and their maintenance in a separate fund as contained in section 2 (a) of the Act of August 11, 1939, as amended July 1, 1954 (68 Stat. 376), shall be continued for the year ending June 30, 1957, and each year thereafter.

(b) Subsection (e) of section 2 of the aforesaid Act of August 11, 1939, as amended, is hereby amended to read as follows:

"(e) The separate fund created for the use of the Secretary of the Interior under section 2 (a) of this Act and the annual accruals thereto shall be available for each year hereafter until expended by the Secretary."

APPENDIX IV

THE ACT OF AUGUST 11, 1939 (53 STAT. 1411)

AN ACT To authorize the Federal Surplus Commodities Corporation to purchase and distribute surplus products of the fishing industry

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That any part of the funds not to exceed $1,500,000 per year, transferred by the Secretary of Agriculture to the Federal Surplus Commodities Corporation created under and to carry out the

provisions of section 32 of the Act of August 24, 1935 (49 Stat. 774), as amended, may also be used by such Corporation for the purpose of diverting surplus fishery products (including fish, shellfish, mollusks, and crustacea) from the normal channels of trade and commerce by acquiring them and providing for their distribution through Federal, State, and private relief channels: *Provided*, That none of the funds made available to the Federal Surplus Commodities Corporation under this Act shall be used to purchase any of the commodities designated in this Act which may have been produced in any foreign country. The provisions of law relating to the acquisition of materials or supplies for the United States shall not apply to the acquisition of commodities under this Act.

SEC. 2. (a) From the fund authorized to be transferred by section 1 hereof, the Secretary of Agriculture is authorized to transfer to the Secretary of the Interior sums as follows to be maintained in a separate fund, $75,000 which shall be used by the Secretary of the Interior to promote the free flow of domestically produced fishery products in commerce by conducting a fishery educational service; and $100,000, which shall be used by the Secretary of the Interior to develop and increase markets for fishery products of domestic origin.

Approved, August 11, 1939.

APPENDIX V

SECTION 32, AGRICULTURAL ADJUSTMENT ACT OF AUGUST 24, 1935 (49 STAT 774), AS AMENDED

There is appropriated for each fiscal year beginning with the fiscal year ending June 30, 1936, an amount equal to 30 per centum of the gross receipts from duties collected under the customs laws during the period January 1 to December 31, both inclusive, preceding the beginning of each such fiscal year. Such sums shall be maintained in a separate fund and shall be used by the Secretary of Agriculture only to (1) encourage the exportation of agricultural commodities and products thereof by the payment of benefits in connection with the exportation thereof or of indemnities for losses incurred in connection with the production of that part of any agricultural commodity required for domestic consumption; (2) encourage the domestic consumption of such commodities or products by diverting them, by the payment of benefits or indemnities or by other means, from the normal channels of trade and commerce or by increasing their utilization through benefits, indemnities or by other means, from the normal channels of trade and commerce or by increasing their utilization through benefits, indemnities, donations or by other means, among persons in low income groups as determined by the Secretary of Agriculture; and (3) reestablish farmers' purchasing power by making payments in connection with the normal production of any agricultural commodity for domestic consumption. Determinations by the Secretary as to what constitutes diversion and what constitutes normal channels of trade and commerce and what constitutes normal production for domestic consumption shall be final.

The sums appropriated under this section shall be expended for such one or more of the above specified purposes, and at such times, in such manner, and in such amounts as the Secretary of Agriculture finds will effectuate substantial accomplishment of any one or more of the purposes of this section. Notwithstanding any other provision of this section, the amount that may be devoted, during any fiscal year after June 30, 1939, to any one agriculture commodity or the products thereof, in such fiscal year, shall not exceed 25 percentum of the funds available under this section for such fiscal year. The sums appropriated under this section shall be devoted principally to perishable nonbasic agricultural commodities (other than those designated in section 1446 of this title), and their products. The sums appropriated under this section shall, notwithstanding the provisions of any other law, continue to remain available for the purposes of this section until expended; but any excess of the amount remaining unexpended at the end of any fiscal year over $300,000,000 shall, in the same manner as though it had been appropriated for the service of such fiscal year, be subject to the provisions of section 712 and 713 of Title 31.

APPENDIX VI

[PUBLIC LAW 542—75TH CONGRESS]

[CHAPTER 274—3D SESSION]

S. 3595

AN ACT To authorize the purchase and distribution of products of the fishing industry

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That, out of any funds available to the Federal Surplus Commodities Corporation, not to exceed a sum equal to the difference between $1,000,000 and the sum expended by such Corporation in carrying out the provisions of the joint resolution entitled "Joint resolution to make funds available to carry out the provisions of existing law authorizing the purchase and distribution of products of the fishing industry," approved April 12, 1937, may be used by such Corporation for the purpose of diverting surplus fish (including shellfish) and the products thereof from the normal channels of trade and commerce by acquiring them and providing for their distribution through Federal, State, and private relief channels. The provisions of law relating to the acquisition of materials or supplies for the United States shall not apply to the acquisition of commodities under this Act.

Approved, May 25, 1938.

APPENDIX VII

[PUBLIC RESOLUTION 22—75TH CONGRESS]

[CHAPTER 73—1ST SESSION]

H. J. Res. 278

JOINT RESOLUTION To make funds available to carry out the provisions of existing law authorizing the purchase and distribution of products of the fishing industry

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That not to exceed $1,000,000 of the funds available to the Federal Surplus Commodities Corportion may be used by such Corporation for the purpose of diverting surplus fish (including shellfish) and the products thereof from the normal channels of trade and commerce by the acquisition and distribution thereof in accordance with the provisions of the Act entitled "An Act to authorize the purchase and distribution of products of the fishing industry," approved March 5, 1937.

Approved, April 12, 1937.

APPENDIX VIII

[PUBLIC LAW 15—75TH CONGRESS]

[CHAPTER 29—1ST SESSION]

H. R. 4609

AN ACT To authorize the purchase and distribution of products of the fishing industry

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That there is authorized to be appropriated, out of any money in the Treasury not otherwise appropriated, the sum of $2,000,000 for the purpose of enabling the Federal Surplus Commodities Corporation to divert surplus fish (including shellfish) and the products thereof from the normal channels of trade and commerce by acquiring them and providing for their distribution through Federal, State, and private relief agencies. No commodities shall be acquired under this Act after ninety days after the date of its enactment: *Provided however*, that distribution thereof may extend beyond said period. The provisions of law relating to the acquisition of materials or supplies for the United States shall not apply to the acquisition of commodities under this Act.

Approved, March 5, 1937.

APPENDIX IX

Programs and allocations under Saltonstall-Kennedy Act fiscal 1957

I. Research and fish and fisheries (fishery biological studies):	
A. Coastal and offshore fishery research:	
1. Alaska salmon and ecologically related species:	
(*a*) Development of methods of counting and recording escapement	$125,400
(*b*) Studies of migrations, and of predators, effects of logging, and other environmental factors	267,200
(*c*) Development of methods for more accurate predictions of runs	144,000
(*d*) Analysis of accumulated fishery and research data	36,000
(*e*) Identification of Pacific herring populations and development of methods of predicting abundance	83,900
2. Pacific sardine: A cooperative program of research on fluctuation in abundance of Pacific sardine, anchovy, and mackerel	118,700
3. Ocean research: Research on the Pacific Ocean to assemble data on climate and oceanography in order to determine relationship between environment and worldwide fluctuations of the commercially valuable species of fishes	15,000
4. North Atlantic trawl fishes: To secure information on biology of sea scallop, flounders, whitings, advance studies of ocean perch	439,000
5. Herring: Studies on biology of Atlantic herring (sardines)	90,000
6. Gulf of Mexico fishes:	
(*a*) Red tide research: Study of causes and control of toxic red tide in Florida Coast	112,000
(*b*) Shrimp: Research on shrimp nursery grounds and shrimp movements	130,000
(*c*) Improvement of facilities	30,000
7. Atlantic striped bass research: Study of races, oceanic migration, variations in year-class strength, effect of fishing, and evaluation of productivity of different ages and sizes	52,000
8. Menhaden research:	
(*a*) Research on population, age, and distribution of Atlantic menhaden	90,000
(*b*) Research on population, age, and distribution of Gulf of Mexico menhaden	111,000
9. North Pacific oceanic fisheries	90,000
10. King Crab: Studies on biology of Alaska king crab	130,000
Total Coastal and offshore fishery research	2,073,200
B. Commercial shellfishery research:	
1. To intensify research on predators, dependable seed-oyster supply, and quality of marketable oysters from different areas by strengthening research personnel and facilities at existing laboratories:	
(*a*) New England oysters	28,000
(*b*) Middle Atlantic oysters	130,000
(*c*) Gulf of Mexico oysters	25,000
2. Research on biology of Atlantic blue crab	75,000
Total, Commercial shellfishery research	258,000

Programs and allocations under Saltonstall-Kennedy Act fiscal 1957—Continued

I. Research and fish and fisheries—Continued	
C. Pacific oceanic fisheries investigations: To provide additional research on albacore tuna, to define location of stocks in waters north of Hawaii	$227,800
D. Contract research on tuna	640,000
E. Inland commercial fisheries:	
1. Commercial fish propagation	80,000
2. Great Lakes fisheries research	115,000
Total, Inland commercial fisheries	195,000
Total, Research on fish and fisheries (Fishery Biological Studies)	3,394,000
II. Exploration, development, and utilization of fishery resources (Commercial Fishery Studies):	
A. Exploratory fishing and gear research:	
1. Maine sardine explorations: Exploration program in cooperation with biological studies	77,000
2. North Atlantic explorations: Operation of vessel *Delaware;* to explore new fishing grounds	311,000
3. South Atlantic and Gulf explorations: Offshore shrimp exploration to determine commercial potentialities	116,000
4. Gear development and improvement	223,000
5. Maintenance of vessels	30,300
Total, Exploratory fishing and gear research	757,300
B. Fishery technological studies:	
1. Middle Atlantic and Gulf research:	
(*a*) Research to develop proper methods for handling, freezing, and packaging Southern oysters in Gulf and South Atlantic areas	40,000
(*b*) Gulf of Mexico technological program	87,200
2. Development of voluntary standards: Research to develop voluntary Federal grades and standards for various fishery products	277,500
3. Development of chemical index for nutritive value of fish meal: Research to develop more rapid and better means of evaluating the nutritive properties of fish meal. Mostly contract research	93,000
4. Development of new uses for fish oil: Research to find new specific uses for fish oils for a favorable competitive status against existing surplus of domestic fats and oils	208,000
5. Improvement in quality of tuna: Contract study to improve methods of freezing skipjack tuna at sea and to improve tuna quality throughout the processing stages	60,000
6. Radiation preservation studies	80,000
Total, Fishery technological studies	845,700
C. Commercial fishery statistics: Expediting release of statistics and strengthening coverage, especially in regard to shrimp, monthly State landings, and cold storage statistics	250,500
D. Commercial fishery economic studies: For studies, especially on fish consumption, economic surveys of certain segments of the fishing industry, and for administration of Fishery Cooperative Marketing Act of 1934	242,000

Programs and allocations under Saltonstall-Kennedy Act fiscal 1957—Continued

II. Exploration, development, and utilization of fishery, etc.—Con.	
E. Fishery education and market development:	
1. For promoting the use of domestically produced fishery products through educational services and market development activities, particularly school lunch, locker plant and special marketing programs, and foreign industry studies, as required (the listed allocations include $175,000 which was transferred annually for educational and market development activities prior to enactment of the Saltonstall-Kennedy Act)	$367,500
2. Marketing studies, by contract, to determine basic marketing patterns	250,000
Total, Fishery education and market development	617,500
F. Market news—Strengthen market news coverage	101,000
Total, Exploration, development and utilization of fishery resources (Commercial Fishery Studies)	2,814,000
III. Administrative expenses:	
1. Assessment for general administrative services	372,000
2. Advisory Committee expenses	15,000
Total, Administrative expenses	387,000
Total Programs	6,595,000

RECAPITULATION

I. Research on fish and fisheries	3,394,000
II. Exploration, development, and utilization of fishery resources	2,814,000
III. Administrative expenses	387,000
Total	6,595,000

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